

GEORGE C. MARSHALL **SPACE
FLIGHT
CENTER**

ENVIRONMENTAL STATEMENT

FOR THE

GEORGE C. MARSHALL SPACE FLIGHT CENTER

AND

MISSISSIPPI TEST FACILITY

(NASA-TM-X-69369) ENVIRONMENTAL STATEMENT
FOR THE GEORGE C. MARSHALL SPACE FLIGHT
CENTER AND MISSISSIPPI TEST FACILITY
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SUMMARY SHEET

ENVIRONMENTAL STATEMENT GEORGE C. MARSHALL SPACE FLIGHT CENTER AND MISSISSIPPI TEST FACILITY

1. Type of Action: Administrative

2. Description of Action: This statement addresses the George C. Marshall Space Flight Center (MSFC), Marshall Space Flight Center, Alabama and the Mississippi Test Facility (MTF), Bay St. Louis, Mississippi. It is presented in two parts indicated by tabs. MTF is a component installation of MSFC.

3. Scope: Paragraphs 3 through 7 of Sections I and II of this statement discuss the environmental factors specified by section 102(2)(c) of the National Environmental Policy Act of 1969. Specifically, the Act requires that the following factors be addressed:

- a. The environmental impact of the installation:
- b. Any adverse environmental effects which cannot be avoided.
- c. Alternatives to the installation.
- d. Relationships between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity.
- e. Any irreversible and irretrievable commitments of national resources which would be involved.

4. Environmental Impact: There will be negligible adverse environmental effects related to the activities of these two installations.

5. Alternatives: There are no environmentally or economically feasible alternatives to these two existing installations.

6. Coordination: The draft Environmental Impact Statement (EIS) has been provided to the Environmental Protection Agency and other Federal, State and local agencies for review and comment. Comments and responses are presented in Appendix A.

7. Draft Statement to CEQ: March 1971

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SECTION I

MARSHALL SPACE FLIGHT CENTER

SECTION 1

ENVIRONMENTAL STATEMENT

FOR THE

GEORGE C. MARSHALL SPACE FLIGHT CENTER

MARSHALL SPACE FLIGHT CENTER, ALABAMA

1. MISSION

The George C. Marshall Space Flight Center, Marshall Space Flight Center, Alabama, hereinafter referred to as MSFC or Marshall, became a part of NASA in July 1960. Marshall serves as one of NASA's primary centers for the design, development and testing of space transportation systems, including large launch vehicles and engines for programs such as Apollo and the Space Shuttle. The MSFC also has a lead role in space flight payload planning, integration and management of scientific projects such as the High Energy Astronomy Observatory. A recently assigned additional category of roles and missions includes responsibility for a area of environmental resources and applications.

In addition to on-site activities at Huntsville, MSFC manages the Mississippi Test Facility (MTF) at Bay St. Louis, Mississippi and other facilities and offices at or adjacent to industrial sites throughout the nation.

The MSFC is currently involved in the direction and management of the following programs:

a. Current Programs

(1) The Saturn Program, which provides the nation's launch vehicle for manned lunar landing missions and very large payloads, such as the Skylab Workshop, and provides the launch vehicle for earth orbital manned missions.

(2) The Lunar Roving Vehicle, which provides mobility for lunar exploration.

(3) The Skylab Program, including development of ground support equipment and cluster modules such as the Orbital Workshop, Apollo Telescope Mount, Airlock Module, and Multiple Docking Adapter, management of selected experiments, and overall systems engineering and integration of the total Skylab cluster.

(1) The Space Shuttle Main Engine, a high thrust, throttleable liquid hydrogen, liquid oxygen fueled rocket engine, capable of many reuses.

(2) The Space Shuttle Booster, which, together with the Shuttle orbiter, is designed for transporting, placing, and supporting scientific and applications payloads in space.

b. Definition Studies

The Concept Verification Testing Program is an in-house effort to verify the concepts and hardware resulting from NASA definition studies now underway. Primary objectives are to demonstrate representative Shuttle payload concepts and develop interface requirements, and to support design and development of such potential hardware items as the Research Applications Module, Sortic Lab, and the Space Tug. Other mission responsibilities of MSFC include scientific programs designed to obtain high quality, gamma-ray, and x-ray sources. MSFC also has a number of scientific definition studies such as experiment carriers to provide power, crew systems and laboratories for space exploration. Other facets to the space exploration for which MSFC is responsible include space vehicles for the delivery and retrieval of automated payloads and habitable space vehicles. These also provide a versatile and economical laboratory and observatory for manned research and application investigations and experimentations in earth orbit.

c. Research and Technology

The MSFC is involved in a broad based research and technology program, including the management of several other significant research efforts. One of these, presently in the study phase, is an orbiting high resolution optical telescope system, which will provide for astronomical observations beyond the reach of all ground-based telescopes. Also underway, the Advanced Orbit-based Astronomy Program is being managed by MSFC in coordination with the Astronomical community to obtain solar data concurrently with the Apollo Telescope Mount mission. Another research effort is aimed at exploring potential techniques and applications for materials processing in space.

d. Applications Program

The MSFC is also participating in the NASA Applications Program, a major element of which is the Earth Resources Survey Program. The program includes environmental activities at Huntsville and at MTF. These

activities are directed generally toward the application of space technology and associated managerial and technical disciplines to environmental problems. Both at MSFC and MTF, where other governmental agencies are locating selected environmental research activities, interagency and working relationships are being established with federal, state and local agencies to determine ways of utilizing NASA Earth Survey data and techniques.

2. INSTALLATION DESCRIPTION

The George C. Marshall Space Flight Center site is near Huntsville, Alabama, on Army property at the Redstone Arsenal. The Center occupies 1,840 acres under a 99-year irrevocable use permit (with an option to renew) from the Army. The total Redstone Arsenal area, including MSFC, is approximately 40,000 acres. The capital investment as of June 30, 1971, was approximately \$391,694,000. It is the largest NASA Center, employing about 5,500 people as of June 30, 1972. Certain facilities such as the Redstone Arsenal Airfield and some utilities are used jointly by NASA and the Army. The Wheeler Wildlife Refuge of the Department of the Interior (permitted to Department of Army) overlaps part of the MSFC's western and southern boundaries, as indicated in the attached vicinity plan in Appendix B.

The MSFC occupies physical space as follows:

Office and Laboratory	2,212,435 sq. ft.
Test	330,395
Special Purpose	689,126
Support	195,656
Storage	938,665

The host agency, U.S. Army Missile Command, is responsible for all construction and maintenance except that which occurs on MSFC property. However, utilities and roads located on this property are under the host agency's jurisdiction. Pursuant to the transfer agreement between the Department of the Army and NASA in December 1959, the Army still provides, on a reimbursable basis, most utility services including potable and industrial water, electricity, steam, sewage disposal, fire protection, and road maintenance.

The physical layout of the MSFC is shown on the attached Land Use Map in Appendix B. The Land Use Map provides basic data on the various existing activities that occupy land on the MSFC area. The data is used in analyzing the current pattern of land use as to compatibility and functional relationships. Briefly the various areas of MSFC are:

a. The Main Administration area is comprised of a three building complex and is situated in the northern section of the MSFC along Rideout Road.

b. The Laboratories and Offices in general are located in the central east portion of the MSFC area along the two main corridors, Martin Road and Rideout Road. A new area also in the central eastern section, which was converted from a land use of "Warehouse, Storage and Light Industry" to "Laboratories and Offices," is expanding along Mercury Road and Lunar Circle.

c. The Support and Service Operations are centrally located on Rideout Road, and provide for the solid waste collection and transport to the sanitary land fill site operated by the U.S. Army.

d. Industrial Areas include storage and warehousing as well as heavier types of industry, such as machine shops and assembly areas. These areas are scattered throughout the MSFC area with the major concentration being west of Rideout Road.

e. The Hazardous Test Area of the MSFC requires large buffered areas for the safety of personnel and facilities. It is located south of Martin Road. However, there are two significant exceptions: a combustion test cell facility located west of Rideout Road and a mock-up fueling test facility east of Rideout Road. The hazardous operations performed at these two facilities require buffer zones, or safety circles, which restrict intensive development of the areas.

f. The Open Areas consist of two major concentrations of land, the larger being an area northeast of the Main Administration Area and the other being the far west area of the MSFC.

5. ENVIRONMENTAL IMPACT

a. Community Effects

While contributing to the growth of the area, Redstone Arsenal and MSFC by their location have also influenced the pattern of growth of the adjacent communities. The accompanying Vicinity Plan shows how the City of Huntsville is bound by a range of mountains to the east and north and by Redstone Arsenal to the west. This affects the allocation of Land Uses as indicated on the Vicinity Plan. The different land uses are identified by color on the legend.

Further, the effects of the MLC upon the variety, level, and amount of employment provided a gradual change over time in a number of important variables. These included: (1) price-related and non-price-related consumption changes while affecting most directly the cities and towns with the highest and Triana have caused a consistent upgrading of the city's consumption quality of life; (2) the degree of consumer satisfaction in many different areas of life, such as police protection, and satisfaction in their spending habits, including recreation and education; (3) a consistent increase in the quality and quantity of services received; and (4) a consistent increase in the supply of services and resources accompanying the rising prices of services and goods and the better control of basic resources that resulted from the increasing government's population.

Industrial development in Huntsville is dominated by space-related activities. In general, the predominance of space-oriented industrial activity is located in Redstone Arsenal and a major activity is located along the rail-line corridors. There are three major industrial areas of high concentration of employees: the Research Industrial Park immediately north of Redstone Arsenal, the Huntsville Industrial Center located in the Old Lincoln Mill in the northeast sector of the City, and the Madison County Industrial Park. The Research Park complex has approximately 5,000 acres of land available for research and industrial uses. This area is developing, and together with the adjacent University of Alabama, Huntsville will further increase as a major determinant in new patterns of employment concentrations. The 800-acre Madison County Industrial Park is located in the northeast section of Huntsville. Two new plants, one manufacturing air conditioning equipment, and the other plants for aircraft, have recently located here.

Employment areas are thus concentrated along the corridors of Interstate 75 and the Tennessee River. Two large industrial areas have moved into these areas. Telephone equipment is made laterally south of the railroad yard, and a large rubber processing company is along Highway 20 west, near the airport. An area not presently utilized, the Huntsville riverfront, is ideally suited for heavy industrial development. The area is conveniently served by both rail and barge. Although the area is presently zoned for light industrial development, a city planning commission will free approximately 2,800 acres for development.

1. Introduction

The community growth since the early 1950's has been very rapid. Population in the City of Huntsville in 1950 was about 17,000, in 1960 was 72,063, and in 1971 has grown to 137,801. Educational facilities have expanded 600 percent in the last 20 years. The city's school enrollment has grown from 5,423 in 1956 to 35,472 students enrolled in 36 schools in 1970.

c. Air

The Government's activities at MSFC do not contribute significantly to the air pollution problem of the region. However, all sources and potential sources must be watched carefully as this installation and the City of Huntsville are located in an area which is highly susceptible to air pollution. The nearby mountains to the east and south tend to pocket air masses and when inversions and stagnant major air systems occur, air pollution levels build up quickly. Marshall Center cooperates with the City Air Pollution Control Office by limiting open burning and controlling other activities which would add to the problem of particulates in the air.

(1) Air Sampling

The MSFC collects and analyzes air samples and conducts other tests as required to establish and control the air quality at the Center. During beryllium machining operations, atmospheric samples are collected to assure that concentrations of beryllium being exhausted to the outside air do not exceed the limits established by the U.S. Atomic Energy Commission.

(2) Total Particulates

A program of sampling for total particulates in the air was established in early 1970, and sampling has continued periodically at several locations on MSFC. The measurements from these stations provide guidance for air pollution control at MSFC and also provide additional regional information to the City of Huntsville Air Pollution Control Board.

(3) U.S. Army Heating Plant

The Department of the Army provides MSFC with all the necessary steam for heating and industrial operations such as plating, or steam cleaning. The steam heat is presently being generated from soft coal, but funds have been approved in the Army's fiscal year 1972 budget for conversion to natural gas, with oil as a standby. Plans are being formulated to pipe in the natural gas from the mainline on Highway 20, between Huntsville and Decatur.

(4) Proposed Air Monitoring Program for MSFC

An air monitoring system is planned for measuring sulfur dioxide, nitrogen oxides, photo chemical oxidants, carbon monoxide, and hydrocarbons. The proposed program requires assaying the MSFC ambient air environment for the purposes of:

MSFC collects samples on weekdays from the industrial sewage lagoon and the outfalls of the major storm drainage system into Indian Creek. These samples are analyzed to insure compliance with state water quality standards. Waters in the industrial lagoon are treated to maintain the effluent pH within the range of 6.0 to 8.5. MSFC has applied to the Corps of Engineers for the necessary permits to discharge into Indian Creek under the terms of Sections 13 of the Rivers and Harbors Act of 1899.

(3) Thermal Discharges into Indian Creek

A study has recently been conducted on the effects of thermal pollution to Indian Creek resulting from the thermal discharge from once-through cooling systems. The study showed that the temperature changes of the receiving water did not vary from ambient conditions by more than 3 degrees to a maximum of 77°F.

(4) Metal Plating Wastes

Building 4760 houses plating and metal surface treating operations. These tanks are set inside of saucer-like tanks to catch spillage and overflows. Complete refurbishment of this facility is about 75 percent complete.

Concentrated wastes, other than cyanide wastes, are drained from buildings 4760 and 4707 via chemically resistant sewer lines, to a lined concentrate receiving lagoon (100,000 gal. capacity). These wastes receive treatment by mixing alkaline wastes with acid wastes, either in the concentrate receiving lagoon or in a smaller transfer lagoon (7,500 gal. capacity), and are then further concentrated by means of an evaporator. The resulting liquors are pumped into the ultimate disposal lagoons (200,000 gal. capacity each). No concentrated wastes or cyanide wastes are ever discharged into Indian Creek. Cyanide containing solutions (440 gallons in 1970) are pumped into drums and shipped to a commercial firm for disposal. In case of an emergency, cyanide wastes can be transferred to a cyanide lagoon (15,000 gal. capacity) located separately from the main industrial waste treatment facility.

(5) Proposed MSFC Water Monitoring Program

Almost five years prior to the issuance of Executive Order No. 11507, in February 1970, a brief survey of the concentrations and quantities of pollutants discharged from the Industrial Sewer had been performed. Based on this survey the present Industrial Waste Treatment Plant was designed and built. In April 1970, a more comprehensive survey was performed for the

entire Redstone Arsenal area by the U.S. Army Environmental Hygiene Agency. Additional analyses of effluents into Indian Creek were later determined in 1970 under the direction of Dr. Lorraine P. Morin of the University of Alabama in Huntsville. All of these data, supplemented by many analyses determined by the Materials Division of the Astronautics Laboratory (S&E-ASTN-MC), provided the quantitative information required for the preparation of the MSFC applications for Corps of Engineers discharge permits under the 1899 Refuse Act.

There are normally three waste water streams which continuously discharge from MSFC into Indian Creek (Streams 001, 003, and 004) with two additional sources of waste water which may on occasions discharge directly into Indian Creek (Streams 002 and 005) for which Corps of Engineers' permits have been requested. These are as follows:

<u>Discharge Designation</u>	<u>Source of Discharge</u>
Stream 001	Industrial Sewage Lagoon
Stream 002	Industrial Sewer
Stream 003	Storm Drain (Lateral A)
Stream 004	Storm Drain (Lateral B)
Stream 005	Hydrostatic Dump Lagoon

Streams 001 and 002 are predominantly water rinsing from metal plating and other surface treatment operations. Stream 002 represents the direct discharge from the Industrial Sewage System. Stream 001 represents the discharge from the Industrial Sewage Lagoon, through which Stream 002 must pass before being permitted to discharge finally into Indian Creek.

Streams 003 and 004 are the discharges from two storm drainage systems (Laterals A and B, respectively) whose discharges are mainly warmed industrial water which has been used as coolant in various building air conditioning systems. The Hydrostatic Dump Lagoon (Stream 005) is no longer used for its original purpose, and its future use will be for reserve storage for the main industrial lagoon.

The data included in the above permit applications are given in Table 1 (Appendix D).

Discharge standards for stream 001 have been provided by EPA and are given in Table 2 (Appendix D).

A planned waste water monitoring program is summarized in Table 3 and Figure 1 (Appendix D). Phase I of the program calls for:

(a) Daily collection of 24-hour samples obtained by continuous proportional-flow compositing of Streams 001 through 004.

(b) Manual determination of the instantaneous stream temperatures, flow rates, and Ph at the time the daily composite samples are gathered for analysis.

(c) Immediate analysis of each daily composite sample for specific parameters as listed in Table 3*.

(d) Later analysis of the weekly composite samples for Streams 001 and/or 002 for all the other parameters listed in Table 2 (Appendix D).

Phase II of the program calls for continuous monitoring and recording of the electrical conductivity (dissolved solids), oxidation-reduction potential (ORP), Ph, flow rate, and temperature of all four streams listed in Table 3 (Appendix D). Stream 002 will be monitored to detect excessive pollutant concentrations as early as possible. This will allow immediate corrective action to be taken before harmful concentrations could appear in Stream 001. It is planned that additional continuous monitoring equipment be provided as close as practicable to all major possible sources of pollution as shown in Figure 1 (Appendix D) i. e., monitoring locations 1 through 8.

With the onset of Phase II of the program, it is expected that as much as possible of Phase I of the program will be gradually discontinued. However, until reliable methods for the continuous monitoring of critical pollutants such as total chromium and total cyanide become available, at least a portion of Phase I will have to be continued. Likewise, it should be possible to reduce Phase II of the program with the accumulation of operating experience.

Phase III of the program calls for the continuous monitoring of specific, critical parameters such as total chromium and total cyanide, if and when instrumentation for this purpose becomes available.

*A few of these are critical parameters such as total chromium and total cyanide, which should be analyzed with minimum delay; and it is planned that the remainder of the listed parameters be determined daily, for the purpose of developing empirical correlations among these data and various pollutants.

e. Noise

(1) Noise Surveys

The MSFC performs noise surveys to assure that sound pressure levels are within those criteria established by the American Conference of Governmental Industrial Hygienists. Representative areas are machine shops, carpenter shops, pneumatic test areas, equipment rooms, MSFC aircraft, rocket engine test areas, computer areas, etc. Those criteria are as follows:

<u>Duration</u> <u>Hours/Day</u>	<u>Sound Level</u> <u>(dBA)^a</u>
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.75	107
0.5	110
0.25	115-C ^b

(Note:) (a) For additional information, refer to these documents: Guides for the Evaluation of Hearing Impairment; Transactions of the American Academy of Ophthalmology and Otolaryngology, pp. 167-8 (March-April 1959); Guides to the Evaluation of the Permanent Impairment - Ear, Nose, Throat and Related Structures; and Journal of the American Medical Association 197:489 (August 1961).

(b) The sound level is given in decibels as measured on a standard sound pressure level meter operating on the A-weighting network with slow meter response. Ceiling value denoted by "C" is the maximum dBA to which a person may be exposed.

Noise falls into two categories: that within the community; and that within the local working environment. The only excessive noise operations which might contribute to community exposure are engine test firings. The MSFC uses criteria (115dB), which has resulted from extensive noise studies in the surrounding area to determine if conditions are suitable for such firings. No tests are conducted until determinations are made that meteorological conditions are suitable and that attenuation will be in accordance with established criteria. In the working environment, studies are performed to determine if sound pressure levels are excessive. If high

levels are found, corrective measures are recommended in the form of engineering changes and personnel protection. All personnel who work in noisy occupations are given periodic audiometric examinations.

(2) Engine Test Firings

(a) Model testing of rocket engines at building 4540 is described in Appendix C. This model engine will have a thrust of less than 50,000 lbs. No adverse environmental effects will result from this testing. A discussion of this program and its effects are included in Appendix C.

(b) In the last several years occasional tests have been conducted of 200,000-pound class liquid oxygen-liquid hydrogen rocket engine at building 4514. The effects of these various tests have not been shown to be physically harmful to nearby wildlife. Frequent observations of the wildlife have been made by the Wheeler Wildlife Refuge personnel and no complaints have been brought to the attention of the MSFC. Sound pressure contours for testing at this facility are shown in Appendix C.

(c) The above described testing has not caused any significant addition to the adjacent acoustical environment, primarily because of the manner in which the Redstone Arsenal acts as an acoustical buffer zone and because tests are carefully scheduled so that atmospheric conditions contribute to attenuation and do not cause refracted concentrations. Early in the test program some relatively few complaints of superficial structural damage to plaster, etc., had been received. Straight monitoring of the meteorological conditions have optimized test periods such that no farfield communities are subjected to environments which induce damage claims.

f. Solid Waste

Solid wastes include paper, wood, metal, grease, glass, plastic, etc. These are collected by MSFC on a periodic basis at predetermined locations. Metals and other salvagable material amounting to approximately 4,000 cubic yards were transferred to the U.S. Army's salvage yard in FY 1971. Other wastes such as paper, trash, scrap wood, and food amounting to approximately 84,000 cubic yards in FY 1971 were carried to the U.S. Army's sanitary land fill for disposal by the Army. About 500 pounds per week of computer punch cards are recycled.

g. Pest Control

Pesticides are used at MSFC to protect plants, buildings and foods from damage and destruction as well as promote the health and well-being of personnel. Materials used, purposes and methods of dispensing are as follows:

<u>Material</u>	<u>Use</u>	<u>Application</u>
Prometone 25E, (500#/year)	General vegetation and soil sterilization	10% solution ground spray
Warfarin 5% (150#/year)	Rodents control	.025% bait
Diazinon 48% (20#/year)	Roach control	.5% solution hand spray
Chlorodane (20#/year)	Termite control	10% solution spray injection
Malathion 30% (75#/year)	Mosquito and fly pest control	Fog generator

All chemicals are applied by certified, trained personnel provided with necessary safety equipment. These small applications are authorized only under conditions where controls can be enforced to protect against environmental contamination.

4. ADVERSE ENVIRONMENTAL EFFECTS

The activities at the MSFC have negligible adverse effect on the environment.

5. ALTERNATIVES TO THE INSTALLATION

The MSFC institutions have been in existence for some time, with negligible adverse impact to the environment. Continuance of the current and proposed projects at MSFC are essential to the NASA Space Programs. An expenditure larger than \$391.6M would be required to duplicate these facilities elsewhere with attendant environmental impact.

6. SHORT-TERM USES VERSUS LONG-TERM ENHANCEMENT OF THE ENVIRONMENT

The MSFC has undertaken several actions to insure that short-term activities are in accordance with the long-term objectives of protecting and enhancing the environment. These have been implemented through management directives, standard operating procedures, and continuing surveillance of activities to insure compliance with the Nation's Environmental objectives.

Management of the grounds and lands at MSFC is conducted in such a way as to insure continued enhancement of the environment.

Open areas, slopes, banks, and open ditches have been grassed or planted to control erosion and reduce water runoff rates. Tree planting and landscaping are done in accordance with the overall landscaping plan and are carried on as continuing programs.

Wooded areas are protected from fires by proper clearing and maintenance of fire breaks. Young trees in new groves are thinned periodically to promote vigorous and healthy growth of the remaining trees. Older stands of trees are selectively cleared, harvested and replanted to insure a balance growth of a wide variety of healthy tree specimens.

A comprehensive survey of all MSFC wastes was completed in FY 1971. The purpose of this survey is to identify quantitatively and qualitatively all the solid and liquid wastes generated at the Center, including possible pollutants. This information is being analyzed for possibilities of recycling reuseable items, selling items that can be reprocessed and collecting and controlling pollutants.

Working with the Top of Alabama Regional Council of Governments (TARCOG), the City of Huntsville, Madison County and the U.S. Army, the MSFC has conducted a feasibility study for a solid waste-fueled steam generation plant which would be located at MSFC. This plant would use solid wastes from the U.S. Army, MSFC, the local communities and Madison County, Alabama to generate steam. The steam would be used by MSFC for heating in the winter and operating steam-turbine driven air conditioning equipment in the summer. The economics for the building and operating of this type steam plant are favorable. The TARCOG, City of Huntsville and Madison County have a very difficult solid waste disposal problem which would be alleviated by the installation of this plant. The austere funding future forecast for NASA would seem to rule out building this project with NASA funds. Other methods of funding are being studied.

7. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

There are small commitments of environmental resources that are considered irreversible and/or irretrievable. These consist of minor amounts of fuel oil and electricity used to power various systems throughout MSFC. This installation has induced an accelerated growth in surrounding areas which has contributed to private commitments in such areas as land development, community locations, and road networks.

8. DRAFT ENVIRONMENTAL STATEMENT REVIEW COMMENTS

A draft environmental statement for the MSFC was submitted to NASA Headquarters February 1971. Comments to the draft EIS have been received from the EPA. The comments and responses thereto are included in Appendix A.

SECTION II

MISSISSIPPI TEST FACILITY

SECTION II
ENVIRONMENTAL STATEMENT
FOR THE
GEORGE C. MARSHALL SPACE FLIGHT CENTER
MISSISSIPPI TEST FACILITY
BAY ST. LOUIS, MISSISSIPPI

I. MISSION

The Mississippi Test Facility, Bay St. Louis, Mississippi, hereinafter referred to as MTF, is a component installation of the George C. Marshall Space Flight Center and is responsible for conducting programs and activities in Environmental Programs and Rocket Testing Programs.

a. Environmental Programs

Applied research is being conducted in environmental and resources information management to develop techniques and systems to facilitate the flow of data from sensor to decisionmaker. This research will focus generally on the conversion of data to useable information in a decisionmaker's frame of reference, and the integration of the process by which information is disseminated from functionally responsible data collection agencies to eventual users. A primary effort will be to develop interfaces and working relationships with Mississippi, Louisiana and Arkansas together with related federal agencies, to determine ways of utilizing NASA technology, management skills, and earth survey data to solve environmental problems in the context of a regional experiment. Selected projects, such as the Atchafalaya River Basin Project, will be used to obtain actual experience. In conducting such research, the MTF scope of activity will not include direct responsibility for sensing or primary collection of data, nor will MTF be involved in the user's decisionmaking process.

As a part of its mission for environmental activities, MTF will be responsible for providing a feedback of payload and experiment ideas for future NASA programs. Also, MTF will provide for an active information and technology interchange among federal and state agencies located at the site. This interchange will seek to capitalize on the interdisciplinary nature of environmental problems and provide an opportunity for synergistic benefits to current and future projects of NASA and other agencies. The following is a listing of other organizations in residence at MTF who are conducting applied research in environmental and resources information management:

(1) Environmental Protection Agency

- (a) Water Quality Field Laboratory (WQFL)**
- (b) National Pesticide Monitoring Laboratory (NPML)**
- (c) Pesticide Chemical Regulation Laboratory (PCRL)**

(2) National Oceanic and Atmospheric Administration (NOAA)

- (a) National Marine Fisheries Services (NMFS)**
- (b) National Data Buoy Project (NDBP)**
- (c) National Weather Service (NWS)**
- (d) Environmental Field Experiment Engineering Test and Integration Center (EFTIC)**
- (e) National Oceanographic Instrumentation Center (NOIC)**

(3) National Aeronautics and Space Administration (NASA)

Earth Resources Laboratory (ERL)

(4) U.S. Geological Survey (DOI)

- (a) Water Resources Division (WRD)**
- (b) Earth Resources Observation Satellite (EROS)**
- (c) Universities**

(a) Louisiana State University

(b) Mississippi State University

(c) University of Southern Mississippi (Proposed)

(d) U.S. Army Munitions Command - Edgewood Arsenal

B. Rocket Testing Programs

Ensuring the maintenance of a NASA launch vehicle and rocket engine static testing and certification capability for both current and future programs. This presently includes preparation for sea level and simulated throttling testing of the Space Shuttle's Orbiter Main Engine, and Orbiter Stage (clustered engines) propulsion system testing.

2. INSTALLATION DESCRIPTION

On October 25, 1961, NASA announced that a test facility (MTF) would be located in Hancock County, Mississippi, which would be designed as a proving ground for Saturn V launch vehicle stages and engines. This site is located approximately 55 miles northeast of New Orleans, Louisiana, between Picayune and Bay St. Louis, in Hancock and Pearl River Counties, Mississippi. The attached Regional Map (Appendix B) shows the MTF location and the nearby communities.

Through the U.S. Army Corps of Engineers, NASA purchased 13,248 acres outright, and secured easements or purchased an additional 125,442 acres surrounding the site to serve as an acoustical buffer zone. This buffer area is now inhabited only by livestock and wildlife, with farming and lumbering permitted. No one is allowed to reside in the area.

During its development, this installation ranked with the major construction projects of the country with a total investment of approximately \$350,000,000. The MTF, as shown on the attached plan (Appendix B), has a navigational lock (110 by 690 ft.) with a maximum lift of 20 ft. for entrance from the East Pearl River to 7.5 miles of manmade canals. The canal system extends to the base of each of the huge test stands, stage storage areas and to fuel storage facilities. This permits test articles and propellants to be delivered directly to their respective use areas.

Buildings reflecting contemporary architecture are grouped in areas such as, Engineering and Administration, Maintenance, Stage and Propellant Storage, and Test.

Within the Engineering and Administrative area, the buildings are primarily for office space, data processing, and laboratory and test control.

The buildings located with the Maintenance area are used primarily for maintenance of facilities and equipment, warehousing, shop support, transportation, storage, and limited office space to support the functional area.

The Stage and Propellant Storage area is the central point of the liquid oxygen (LOX), liquid hydrogen (LH₂), nitrogen, and other gas storage which is essential for the completion of the vehicle certification.

The Test area facilities are for static test firing of the Space Shuttle Orbiter and Main Engines and are provided with specially constructed pipes for the pumping of LOX and LH₂ fuel to the test stands.

3. ENVIRONMENTAL IMPACT

a. Community Impact

Nearest the MTF are the small communities of Nicholson in the northwest, Pearlington in the south, and Kiln in the east. Their economy has not been drastically affected by their proximity to the MTF. The major communities in the immediate vicinity such as Bayou de l'Enfer, Mississippi to the north; Slidell, Louisiana to the west; and Bay St. Louis and Waveland, Mississippi to the east; have shown a considerable increase in the economic status.

Some of the major communities have increased their facilities by as much as 200 percent since the establishment of the MTF. Improvements in public utilities, as well as construction of new schools and new housing have been provided for the increase in population.

The initiation of this mammoth construction project in 1963 created an influx of people to the local communities surrounding the site. The inflow continued until a peak of about 6,000 was reached in August 1965. Since then there has been a steady decline to the present estimated 1,000.

The greatest impact of MTF personnel was in Hancock and Pearl River counties with some spill over into the western fringe of Harrison County (Pass Christian), particularly in housing. The four years of 1962-1965, coinciding with the startup and peak employment years of the MTF, account for about 70 percent of the housing starts in Waveland, Bay St. Louis, and Bayou de l'Enfer over the decade of 1960-1969. The local communities in their efforts to accommodate this influx of people over extended them. They had to supply the much needed military improvements and services. The needs of construction workers left the communities in tight circumstances in order to pay off increased (new to several) bonded indebtedness.

It is estimated that only 10 to 15 percent of the construction workers stayed in this area. This decline, over a short period of time, caused a few small businesses to close with the people seeking employment elsewhere. The cities of Bay St. Louis and Waveland were the most overbuilt and therefore were the most affected. Pass Christian was hurt more with the gradual reduction of the higher salaried employees from MTF.

MTF operations personnel, both contractor and civil service, whose numbers have declined comparatively less than construction personnel, have contributed both culturally and economically to the local communities. Loss or relocation of these personnel through lack of Government programs at MTF would have an environmental impact because of declining tax revenues.

b. Noise

Static firing test activities at the MTF in support of NASA's rocket development efforts have been studied carefully using data from the recent Apollo testing program and projections from the Space Shuttle program. These studies have shown that no damage will occur to personnel in the area outside the buffer zone. Further, observations of children during the testing of the Apollo program have shown no adverse effects due to acoustics. The relatively lower power levels of the Space Shuttle main engine and the Orbiter Stage to be tested at MTF impart a lesser acoustic impact on the environment as shown in Appendix C, Table 1.

Protection against the effects of noise exposure is provided when the sound levels exceed 90 dBA for an eight hour day. When personnel are exposed to sound exceeding this limit, feasible administrative and engineering controls are utilized (refer to Section 1, paragraph 3c).

Tests are conducted to maintain surveillance of possible excess noise areas. If such areas are discovered, suitable restraints and/or controls are applied. It may be possible to eliminate or reduce the intensity of the sound producing elements. If it is not possible to reduce sound levels to within acceptable limits, protective personnel equipment is provided. The combined effect of the sounds produced is the criteria considered in effecting control.

Protection to the adjacent communities from the effects of rocket engine testing is provided through the physical separation afforded by the buffer zone. Further protection is effected by scheduling tests at such times that the meteorological conditions will not focus or multiply sound waves from the tests within a highly localized area. Studies of the noise levels to adjacent communities resulting from orbiter stage and main engine testing are included in Appendix C, Table 4.

c. Air

The orbiter stage and engine propellants (H₂ and LOX) produce water vapor and free hydrogen from the combustion process. The release of free hydrogen imposes no hazard to the environment. Other current programs of other governmental agencies at MTF do not involve toxic materials or do not involve the use of toxic materials to any extent that will endanger the environment.

There are three 15 million BTU per hour hot water boilers located in the test complex heating plant. Three 40 million BTU per hour hot water generators are located in the support area heating plant. These boilers are natural gas fired. Operations are adjusted, based on the gas analysis, to insure complete combustion.

Ten diesel engines are located in the industrial zone power house. These engines use No. 2 fuel oil and are rated at 1000 brake horsepower (BHP) each. The four diesel electric generating units are rated at 2120 BHP and also use No. 2 fuel oil. These engines are operated at a high degree of efficiency to minimize air emissions.

No continuous open burning is planned. Any open burning (such as minor construction debris) will conform to the requirements of the Mississippi Department of Air and Water Pollution Control. As employment and activities significantly increase, an air pollution monitoring program will be initiated and pollution control equipment installed.

d. Liquid Waste Disposal

(1) Sanitary Sewage System

Sanitary sewage is treated by three waste stabilization ponds of the Aerobic type. The ponds were designed for a population of about 5,000. Concurrence of the Mississippi State Department of Health was obtained prior to construction. Present employment is about 1,000. The ponds have proved more than adequate and no problems have arisen. In the event that the sanitary population projection of 5,000 is reached, the ponds will be enlarged. The effluent from the ponds is used for irrigation of the plant grounds and the surrounding area. The ponds are monitored monthly for pH, BOD, turbidity, and other parameters. In addition, it is planned to monitor, on a monthly basis, the effluent from the ponds for copper, cadmium, chromium, nickel, and zinc.

(2) Industrial Waste

Minor amounts of liquid chemical waste are added. The acidic materials are neutralized and discharged through the effluent discharge area consisting of leach pits lined with oyster and shell waste. Acids are neutralized by mixing with an alkali solution. After treatment, the effluent is diluted with water prior to discharge. The leach pits are inspected periodically, and a proper chemical balance is maintained. Additional chemicals are added, as needed, to achieve a pH factor of six to eight before discharging into the river. Chemicals that are toxic or voluminous in nature are disposed of by shipment to an off-site processor.

e. Solid Waste

The nature of the terrain at the MTF is such that the use of sanitary landfill presents no problem. The current rate of 4,750 cubic yards per year presents no immediate problem. At the current rate, or at any foreseeable rate in the future, landfill can continue for many years without an adverse effect on the environment.

Solid Wastes are collected by dumpster-dumpster type containers located throughout the installation in accordance with NFPA code no. 82A. The containers are picked up periodically and transported to the sanitary landfill where the contents are emptied into the landfill. Landfill operations are carried out in accordance with Department of the Army Technical Manual 5-814-5, Sanitary Fill, and ASCE Manual No. 39.

f. Pest Control

Pesticides now in wide use at the MTF are water based. Several years ago, it was decided to go to the water base rather than the petroleum base as a precaution against mixing with liquid oxygen in the event of a spill. The pesticide agents now in use are:

<u>Material</u>	<u>Use</u>	<u>Application</u>
Malathion Premium Cythion 95% 8 oz by wt	Mosquitos Sandflies Midges	ULV Mist 1/2 oz/A 2-3/4 oz/min at 10 mph
Chlor-Dibrom 58% E.C.	Mosquitos Sandflies Midges	0.02#/acre
Bagon 17%	Wasps, bees, etc.	Residual emulsion 1.1% spray
Al Seccitt Triphenylborate	Rodents	Bait 0.005%
Malathion 25%	Insects affecting turf	Spot treat 1/2#/acre
2, 4-D	Weed and brush	Spot treat 4#/gal emulsion
Paraquat 29.1%	Grass-Chemical Trimming	Spot treat 1#/acre

Mosquito control determinations are made by fully trained biologists in coordination with USPH, EDA and Gulf States Council on Fisheries, Wild Life and Mosquito Control. Chemical recommendations are made following inspection of sites.

The use of paraquat requires low pressure equipment with a long wand treating only on low wind days. Protective clothing, aspirators and gloves are used. All personnel are monitored for cholinesterase levels three to four times per year.

4. ADVERSE ENVIRONMENTAL EFFECTS

The activities at the MTF have negligible adverse effect on the environment

5. ALTERNATIVES TO THE INSTALLATION

The MTF institutions have been in existence for some time, with negligible adverse impact to the environment. Continuance of the current and proposed projects at MTF is essential to the NASA Space Programs. Since its capital investment is \$350,000,000 an expenditure of a greater amount would be required to duplicate these facilities elsewhere.

6. SHORT-TERM USES VERSUS LONG-TERM ENHANCEMENT OF THE ENVIRONMENT.

The continued operation of this installation will greatly benefit the residents of the towns and communities surrounding the site. These benefits will be realized in promoting an economic stability. An increase in activity at MTF will probably lead to an increase in personnel and therefore an increase in the tax base. An economic upturn in this area will help the small towns pay their bonded indebtedness to the benefit of local citizens. The economic enhancement to this area more than compensates for any minute amount of environmental degradation.

a. Environmental Enhancement

During the construction of the canal systems to serve the Test area, a study was made of rainfall data, hydrologic data, and possible solutions for drainage and erosion control. Natural drainage was preserved and artificial drainage was provided where necessary. Some areas were filled with soil that was excavated from the canal to provide for gravity drainage and to allow for controlled ponding under high water conditions.

Low land areas were backfilled to a level suitable for ponding under the most severe rainfall conditions, with slopes to allow for gravity drainage into the canal system. All other areas were sloped for proper drainage of facilities, as required. The grading plan provided for an excellent drainage and erosion control system while providing a use for excess excavated material.

Roads and grounds personnel maintain a continuing surveillance of the effects of rainfall in the Fee Area. Specific performance is spelled out in directives and procedures to counteract soil erosion as a result of run off. In extreme instances of soil disturbances, soil cement stabilization is applied to preserve the existing terrain.

The MTF has developed a landscaping plan which is designed to accomplish these purposes:

- (1) Orderly, comprehensive site development to provide screening, noise buffering, soil conservation, and aesthetic development through the selective use of trees, shrubs, and grass.
- (2) Enhancement of the existing forest-tundra terrain through preservation of the flora and fauna compatible with the site functions.
- (3) Provision of an attractive setting for the enjoyment and appreciation of site personnel and visitors to the area.

Proper consideration of the interrelations between the aesthetic and utility aspects of the landscape design will produce the ultimate in what is attractive, and at the same time, advantageous from a utility and maintenance perspective. This balanced intermix between the aesthetic and the utilitarian is being sought as long range landscaping plans are progressively implemented.

An extensive Land Management Plan was prepared by the U.S. Army Engineer District, Mobile, Alabama, for MTF. This included various supplementary plans and recommendations for economic development and management of the resources available at MTF. These resources include land forestry products, wildlife, recreation, and transportation.

The forestry resources are estimated at a current net value to the Government of approximately \$75,000. The forestry plan provides for a program of timber growing in the Fee Area which could be merchantable by 1975. The Forest Fire Council Control Plan prescribes controls for the prevention, prompt suppression, and minimization of grass or forest fires occurring on site.

Good outside working conditions, as well as recreation and pleasant living and housing conditions, are valuable assets that are adequately conserved by the Mosquito Control Plan. The program, initiated in 1964, has produced gratifying results, not only on the site proper, but in surrounding communities.

An abundance of wildlife within MTF contributes to the need for the Wildlife Management Plan to conserve and assure propagation of the numerous species of animal, fowl, and fish. This plan provides the guidelines, techniques, and practices to be followed in managing this resource consistent with the NASA-assigned mission at this facility.

MTF is located within a very old and relatively untouched area, rich in historical significance and abundant in unique and interesting folklore. Its potential as a recreational resource is almost unlimited. The Recreation Plan outlines the orderly development and conservation of this natural resource. Two areas have been developed within the immediate vicinity as recommended in the Land Management Plan. The Galabank on the Jordan River, recreational, and natural area sites of old Gainesville, Mississippi, are now functional.

7. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

There are small commitments of environmental resources that are considered irretrievable and/or irreversible. These consist of minor amounts of natural gas, fuel oil, and electricity used to power various systems throughout the site. However, the MTF has induced an accelerated growth in the surrounding area. This growth has contributed to irreversible commitments in such areas as land development, community locations and road networks.

8. COORDINATION WITH LOCAL, STATE, AND FEDERAL AGENCIES

A draft environmental statement for the MSFC was submitted to NASA Headquarters February 1971. It, together with other drafts from other NASA field installations was submitted to CEQ for comments, coordinated with other Federal Agencies, and called to the attention of state and local agencies through notice in the Federal Register (Vol. 36, No. 53, March 18, 1971) all procedures in accordance with NMI 8800.7B. A few comments with regard to MTF Environmental Impact Statement (EIS) were received from Environmental Protection Agency and they have been responded to in detail in the preparation of this final statement. Comments and responses are attached in Appendix A.

APPENDIX A

COMMENTS AND RESPONSES

TO

DRAFT ENVIRONMENTAL STATEMENT

APPENDIX A

ENVIRONMENTAL PROTECTION AGENCY

Comments on the Draft Environmental Impact Statement on the NASA Marshall Space Flight Center, Huntsville, Alabama

In general the impact statement provided a broad overview of ongoing and projected activities at Marshall Space Flight Center. However, specific environmental factors were not addressed in adequate detail to permit a thorough analysis. As a consequence, the following comments should be considered in preparing the final impact statement, or in developing future plans to ensure an optimum environmental posture.

The draft statement indicates that: "MSFC operates an industrial treatment plant which traps all noxious wastes for treatment before discharge or evaporation;" "Standards of the FWQA are met by all effluents which are checked regularly;" and "All restrictions placed by Federal, State, and local agencies on discharge of wastes into the atmosphere or into the waters of the area are being met." However, these statements in themselves do not ensure compliance with requisite Federal, State and local standards. Adequate sampling and analysis is apparently not being conducted to monitor the effluent to assure compliance with Alabama Water Quality Standards nor is there evidence that sufficient data is being collected for development of performance specifications required by Section 5(c) of Executive Order 11507 or of the permit application required by the Refuse Act (33 U.S.C. 407) and Executive Order 11574. Although preliminary steps have been taken in formulating performance specifications for MSFC, effluent criteria apparently have not been developed for MSFC or MTF.

While most concentrated plating wastes are evaporated and the resulting sludge stored at MSFC, rinse waters from the plating operations and other wastes (including boiler waste water, demineralizer regeneration solutions, laboratory drains, some cyanide wastes, some concentrated waste plating solutions, etc.) receive no treatment other than equalization in a holding pond and dilution in the receiving stream. These deficiencies will be alleviated, at least in part, by the proposed projects. As indicated, sanitary wastes at MTF are presently treated in three single-cell sewage lagoons. Routine monitoring should be provided to assure that wastes receive adequate treatment prior to discharge. It is to be noted that EPA is no longer approving single-cell sewage lagoons and consideration should be given to the upgrading of these lagoons to multi-cell facilities.

The statement does not discuss the possibility that ruptures or leaks from plating tanks containing concentrated solutions would cause pollutants

to flow to floor sumps and eventually drain untreated into Indian Creek. Further, there is no discussion of the possibility of accidental tank discharges overloading the treatment facilities. Although present or proposed projects may provide for these possibilities, they should be discussed in the impact statement.

The statement should also address the consequences of any oils, greases, hydraulic oils, solvents and coolants escaping to the Redstone Arsenal sanitary and storm sewers. In addition, the effects of thermal discharges from once-through cooling systems should be discussed.

AIR QUALITY

In order to assess the air pollution impact of the boilers operating in building 4760 additional information should be provided to include: quantity of fuel consumed, quality of fuel (sulfur and heat content) and the type of boiler in use. Additional information should also be provided on nitrogen tetroxide emissions at building 4623.

PESTICIDES

If pesticides are being used at MSFC or MTF the statement should describe insect and pest control procedures in sufficient detail to permit an environmental impact assessment.

RADIATION

No activities involving the use of any radioactive materials or any sources of ionizing radiation are mentioned in the draft statement. Extensive electronic research work is carried out at the facility, but potential sources of non-ionizing radiation do not appear to exist that will present any off-site problems. Operations at the Marshall Space Flight Center need not, in our judgment, be restricted by environmental effects from radiation.

SOLID WASTE

The statement cannot be properly evaluated until current or proposed elements of solid waste management are described both quantitatively and qualitatively. This description should include an operational analysis of systems and methods pertaining to (where pertinent): generation, storage, collection, transport, processing, separation, recovery, recycling and disposal.

In addition, the on-site landfill site for disposal of demolition type waste and the landfill at MTF should be described in greater detail. More information is also needed on the regional council of governments (TARCOG) plan for solid waste management which may provide an acceptable solution to existing practices.

APPENDIX A
ENVIRONMENTAL PROTECTION AGENCY
COMMENTS ON DRAFT ENVIRONMENTAL IMPACT STATEMENTS

1. COMMENT

The draft statement indicates that: "MSFC operates an industrial treatment plant which traps all noxious wastes for treatment before discharge or evaporation; Standards of the FWQA are met by all effluents which are checked regularly; and All restrictions placed by Federal, State, and local agencies on discharge of wastes into the atmosphere or into the waters of the area are being met." However, these statements in themselves do not ensure compliance with requisite Federal, State and local standards. Adequate sampling and analysis is apparently not being conducted to monitor the effluent to assure compliance with Alabama Water Quality Standards nor is there evidence that sufficient data is being collected for development of performance specifications required by Section 5(c) of Executive Order 11507 or of the permit application required by the Refuse Act (33 U.S.C. 407) and Executive Order 11574. Although preliminary steps have been taken in formulating performance specifications for MSFC, effluent criteria apparently have not been developed for MSFC or MTF.

Response: Paragraphs 3d(2) of Section I and 3f^d(2) of Section II have been revised to respond to this comment.

2. COMMENT

While most concentrated plating wastes are evaporated and the resulting sludge stored at MSFC, rinse waters from the plating operations and other wastes (including boiler waste water, demineralizer regeneration solutions, laboratory drains, some cyanide wastes, some concentrated waste plating solutions, etc.) receive no treatment other than equalization in a holding pond and dilution in the receiving stream. These deficiencies will be alleviated, at least in part, by the proposed projects. As indicated, sanitary wastes at MTF are presently treated in three single-cell sewage lagoons. Routine monitoring should be provided to assure that wastes receive adequate treatment prior to discharge. It is to be noted that EPA is no longer approving single-cell sewage lagoons and consideration should be given to the upgrading of these lagoons to multi-cell facilities.

Response: Paragraph 3d(5) of Section I has been revised to indicate the monitoring program. As mentioned in paragraph 3f(1) of Section II, the waste stabilization ponds are currently oversized. The effluent from these ponds is monitored and the treatment system will be upgraded if the quality of the effluent deteriorates.

3. COMMENT

The statement does not discuss the possibility that ruptures or leaks from plating tanks containing concentrated solutions would cause pollutants to flow to floor sumps and eventually drain untreated into Indian Creek. Further, there is no discussion of the possibility of accidental tank discharges overloading the treatment facilities. Although present or proposed projects may provide for these possibilities, they should be discussed in the impact statement.

Response: Paragraph 3d(4) of Section I addresses the precautions against spillages and overflows. Equipment is inspected regularly and carefully. The probability of tanks rupturing with complete loss of liquid is very small. The plumbing has been arranged so that the sumps drain into the concentrate lagoon. An additional ultimate storage lagoon has been added. Also, the Hydrostatic Dump lagoon (which is no longer required for that purpose) will be used as reserve storage for either concentrated spills or industrial waste.

4. COMMENT

The statement should also address the consequences of any oils, greases, hydraulic oils, solvents and coolants escaping to the Redstone Arsenal sanitary and storm sewers. In addition, the effects of thermal discharges from once-through cooling systems should be discussed.

Response: Hydraulic oils, solvents, coolants, and greases in small amounts have occasionally been accidentally introduced into the sanitary sewers. The source of entry is manmade and controllable. Directives have been issued describing acceptable disposal methods with specific instructions not to use the sanitary sewers and storm drainage system for disposal of oils and greases. Paragraph 3d(3) of Section I addresses thermal discharges to Indian Creek.

5. COMMENT

In order to assess the air pollution impact of the boilers operating in building 4760, additional information should be provided to include: quantity of fuel consumed, quality of fuel (sulfur and heat content) and the type of boiler in use. Additional information should also be provided on nitrogen tetroxide emissions at building 4623.

Response: No boilers are located in building 4760. Small boilers are located in the test area at the southern extremity of MSFC. These eleven boilers have a combined capacity of 63,000 pounds per hour and are fired by No. 2 fuel oil. The proposed use of N_2O_4 at building 4623 was never realized and there are no plans to use N_2O_4 at this facility in the future. Paragraph 3c(4) of Section I addresses the air monitoring program at MSFC.

6. COMMENT

If pesticides are being used at MSFC or MTF the statement should describe insect and pest control procedures in sufficient detail to be included in an environmental impact assessment.

Response: Paragraph 6b of Section I and II address the use of pesticides in controlling pests.

7. COMMENT

The statement cannot be properly evaluated until current or proposed elements of solid waste management are described both quantitatively and qualitatively. This description should include an operational analysis of systems and methods pertaining to (where pertinent): generation, storage, collection, transport, processing, separation, recovery, recycling and disposal.

In addition, the on-site landfill site for disposal of demolition-type waste and the landfill at MTF should be described in greater detail. More information is also needed on the regional council of governments (TARCOG) plan for solid waste management which may provide an acceptable solution to existing practices.

Response: Paragraphs 3f of Section I and 3g of Section II addresses solid waste disposal. These paragraphs have been revised to respond to this comment. No demolition type wastes are anticipated at MTF. Rubbish and trash generated during routine maintenance is carried to the landfill for disposal. Paragraph 6, Section I addresses the coordination with TARCOG.

APPENDIX B

MARSHALL SPACE FLIGHT CENTER VICINITY MAP

MARSHALL SPACE FLIGHT CENTER LAND USE MAP

MISSISSIPPI TEST FACILITY VICINITY MAP

MISSISSIPPI TEST FACILITY SITE MAP

[illegible]

WALL SPACE FLIGHT CENTER VICINITY PLAN

ALPINE MOUNTAIN FACILITY

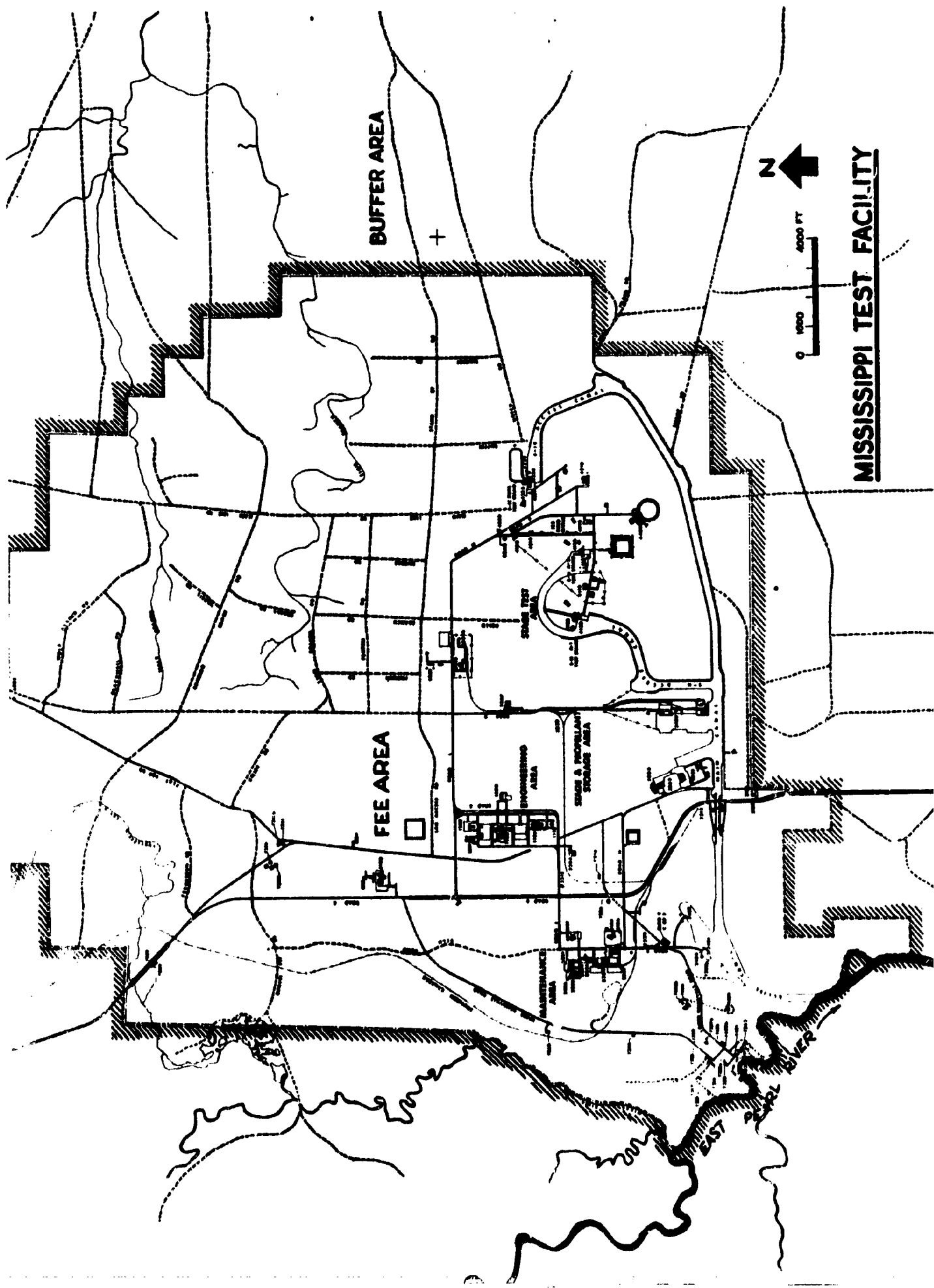
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322030000 ARSENAL

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LITERATURE	
Periodicals	<input checked="" type="checkbox"/> Don't know
College & Univ.	<input checked="" type="checkbox"/> High School &
Nonfiction	<input type="checkbox"/>
Commercial	<input type="checkbox"/>
Technical	<input type="checkbox"/>
Business Books	<input type="checkbox"/>
Public & Semi-Public	<input type="checkbox"/>
Business Reports	<input type="checkbox"/>
MS & C	<input type="checkbox"/>
Y & A	<input type="checkbox"/>
Proposed Association	<input type="checkbox"/>
to Incorporate Books	<input type="checkbox"/>
Y & A	<input type="checkbox"/>
Books	<input type="checkbox"/>

1700 METERS
RADIO INTERFERENCE
FREE ZONE

LAND USE MAP



MISSISSIPPI TEST FACILITY

APPENDIX C

ACOUSTIC REPORTS

- C - 1 ACOUSTIC ENVIRONMENTS FROM TESTS AT
THE ACOUSTIC MODEL TEST FACILITY
(AMTF, MSFC)
- C - 2 ACOUSTIC ENVIRONMENTS FOR J-2 ENGINE
TESTING AT MSFC
- C - 3 ACOUSTIC ENVIRONMENTS AT MISSISSIPPI
TEST FACILITY FROM ORBITER SINGLE
ENGINE STATIC TESTS
- C - 4 ACOUSTIC ENVIRONMENTS AT MISSISSIPPI
TEST FACILITY FROM SPACE SHUTTLE
ORBITER STATIC TESTS

APPENDIX C-1

ACOUSTIC ENVIRONMENTS FROM TESTS AT THE ACOUSTIC MODEL TEST FACILITY (AMTF, MSFC)

Model tests are planned to provide acoustic environmental definition for the Shuttle and its impact on surrounding areas. A scale model of approximately 50,000 # thrust is to be used for the experimental studies (full scale engine thrust is 375,000#). The acoustic environments generated by model tests at AMTF, the environmental estimates and the personnel exposure criteria or limitations are provided herein.

Acoustic Environments

The acoustic spectra provided in Figure 1 represents the maximum octave band sound pressure levels at the distances specified from 20 to 1280 meters, for tests envisioned for support of the Shuttle program. The overall or composite levels are plotted versus distance in Figure 2. The maximum levels specified herein are not induced in all directions for a single fixed model position; however, the model may be oriented in several directional positions thereby possibly inducing the indicated levels to a great portion of all four quadrants. The source is therefore considered omnidirectional for planning purposes in regard to noise exposure. Figure 3 indicates the maximum overall sound pressure level contours anticipated for currently planned tests for Shuttle application.

Test Durations and Frequency

Test durations are normally less than 1 minute; a typical time is 30 seconds. Not more than three tests per day are anticipated. Most tests are conducted in late afternoon, i.e., 4 to 6 p.m., necessarily because of wind constraints in acquiring acoustic field data. Tests would generally be conducted on no more than three days per week. A maximum total weekly firing duration would therefore be 9 minutes, more typically not more than 3 minutes and centered about the 4 to 6 period when winds are generally low.

Suggested Personnel Exposure Criteria for AMTF Shuttle Program

OA SPL's above 125 dB A* (127 dB)** - Ear protection mandatory for all exposed test personnel.

OA SPL's above 115 dB A (118.5 dB)** - No outside personnel exposed. (Access limited to approximately 400 m.) Suggested protection for test personnel with single daily exposure not to exceed 15 minutes.

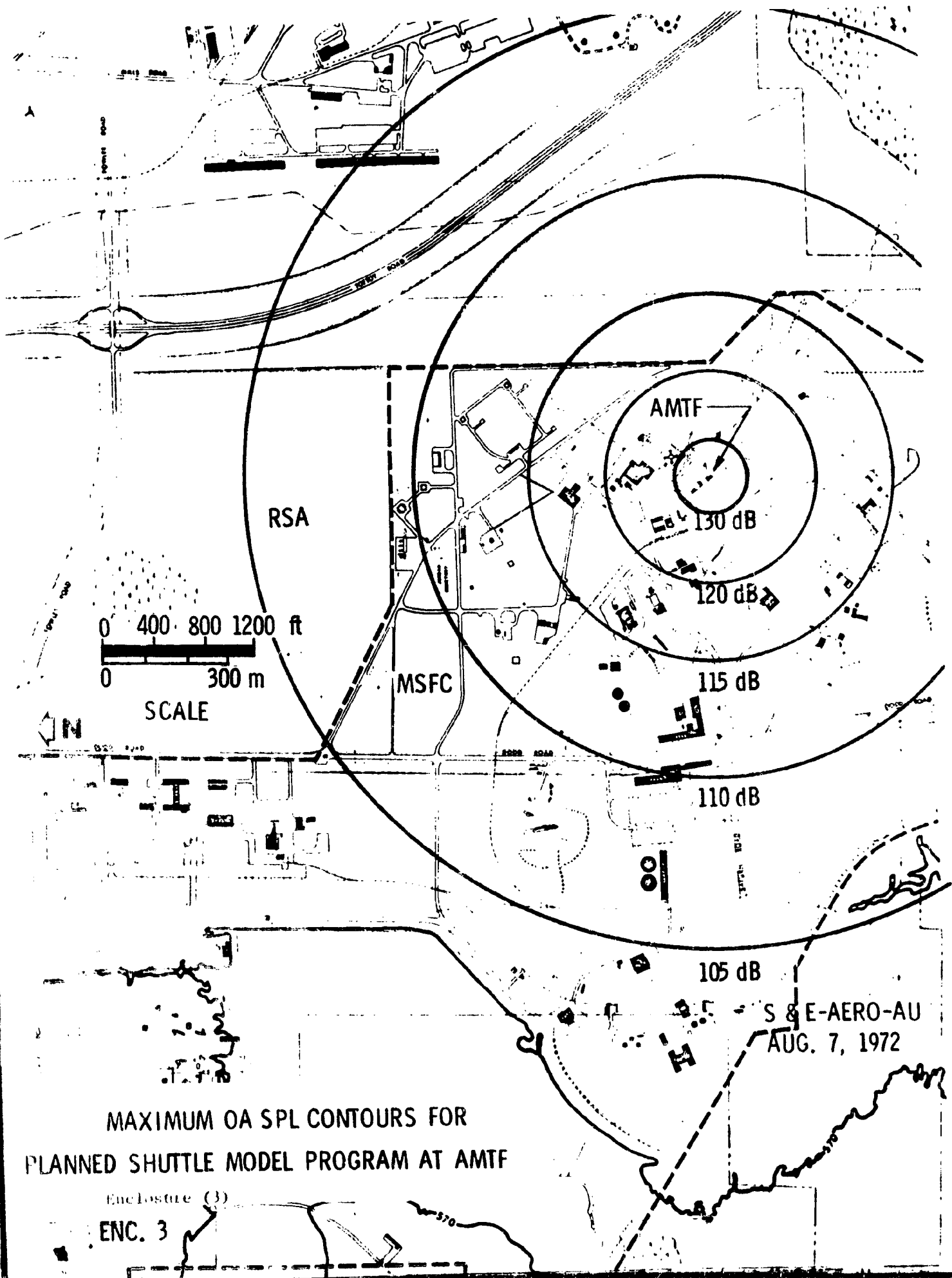
OA SPL's less than 115 dB A (118.5 dB)** - No protection required.

At AMTF the access limits reportedly will be extended to approximately 400 m for more stringent control with the high Pc engine Shuttle program. No environmental problems are foreseen for the areas beyond the controlled access regions.

* dB A denotes "A" scale weighting.

** These dB values are applicable only to the Shuttle model tests at AMTF as stated herein.

All dB Re: $2 \times 10^{-5} \text{ N/m}^2$



APPENDIX C-2

ACOUSTIC ENVIRONMENTS FOR J-2 ENGINE TESTING

AT MSFC

The J-2 engine test program is conducted to investigate special problems associated with flight performance. This is a limited follow-on effort to the major R&D and flight qualification programs of the 1960's. The J-2 engine uses liquid oxygen and liquid hydrogen as propellants. No air or water pollutants are generated as a result of this testing.

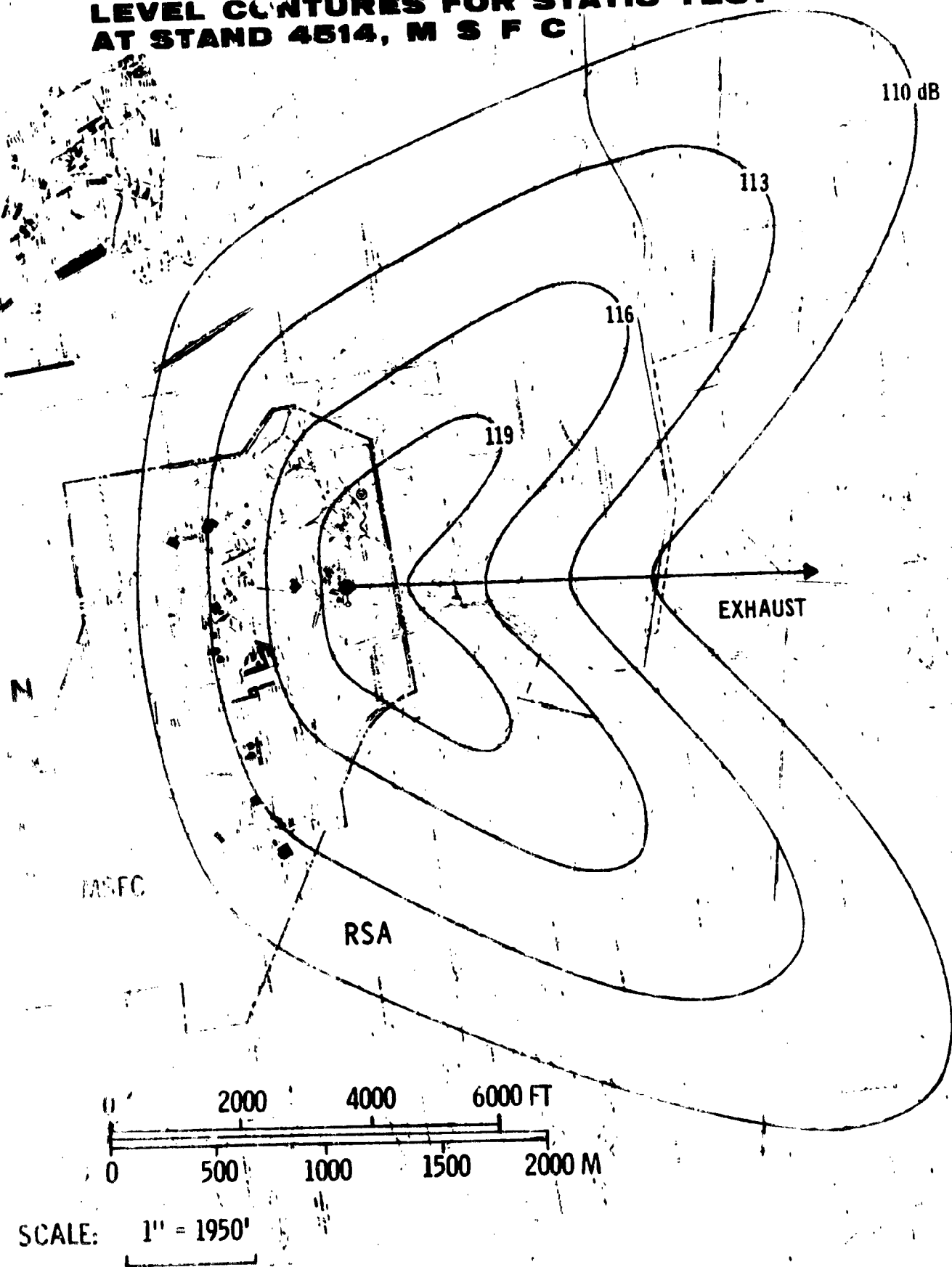
Acoustic Environment

The overall sound pressure levels (OA SPL) for the 200,000 lbs. thrust J-2 is shown in Figure 1, as fired from Stand 4514, just south of the S-1B static test stand (S-4572). The exhaust flow is directed at approximately 190° (re:north) and the maximum radiation lobes are approximately 48° from the flow center line. Since stand 4514 is located near the MSFC boundary, the environments imposed on the adjacent Redstone Arsenal (RSA) property are on the order of 120 dB (re: 2×10^{-5} N/m²). However, this part of the Arsenal is used as a test activity by the J-2 engine testing. The 110 dB contour is still within the RSA boundary and no community environmental criteria are violated.

Test Durations and Frequency

Engine tests are conducted at an average of two per month with a maximum of three per month. The duration of each test is approximately 20 seconds.

**J - 2 ENGINE OVERALL SOUND PRESSURE
LEVEL CONTOURS FOR STATIC TEST
AT STAND 4514, M S F C**



APPENDIX C-3

ACOUSTIC ENVIRONMENTS AT MISSISSIPPI TEST FACILITY

FROM

ORBITER SINGLE ENGINE STATIC TESTS

Acoustic environmental impact on the surrounding community area at MTF for the static firing of a single high Pc engine (orbiter engine) are as follows:

Single Engine of Orbiter:

Thrust = 375, 000 lb.
Vexit = 11,680 ft/sec
Diaexit = 90.7 inches
 \dot{m} total = 1029.5 lb/sec
Bucket deflector

Sound Pressure Level Contours

The overall sound pressure level contours (Fig. 1) for the single engine static tests at MTF indicate that the maximum OA SPL outside the buffer zone is approximately 98 dB (Re: 2×10^{-5} N/m²) occurring in the maximum radiation lobe at $\approx 42^\circ$, referenced to the exhaust flow centerline. The environment is predicted for standard atmospheric conditions with no refractive focusing. Tests are to be conducted when atmospheric conditions are such that no problems from focusing are expected in community areas.

Acoustic Environmental Damage Claims

The acoustic damage claim history, from tests of S-II and S-IC stages at MTF, indicate that the environments produced by the single High Pc engine static test should produce less than one complaint or claim for every 10,000 dwellings exposed to the highest level outside the buffer zone (98 dB). For more remote areas 70,000 to 80,000 feet where levels are diminished, less than one complaint per 100,000 dwellings exposed would be probable.

The noise impact in the area where Federal Highway 10 crosses the MTF buffer zone, about 3 miles SSE of the test area is considered here briefly. The maximum OA SPL is ≈ 90 dB during tests. At approximately 20 mph the internal car environment (with windows closed) is approximately 90 dB (tests conducted by AERO Lab, MSFC). The internal car environment for higher vehicle speed is of course greater than 90 dB and the rocket noise is masked somewhat more. Even though the internal car noise energy spectra is not exactly the same as the rocket noise environment both peak below 30 Hz; thus the internal car environment

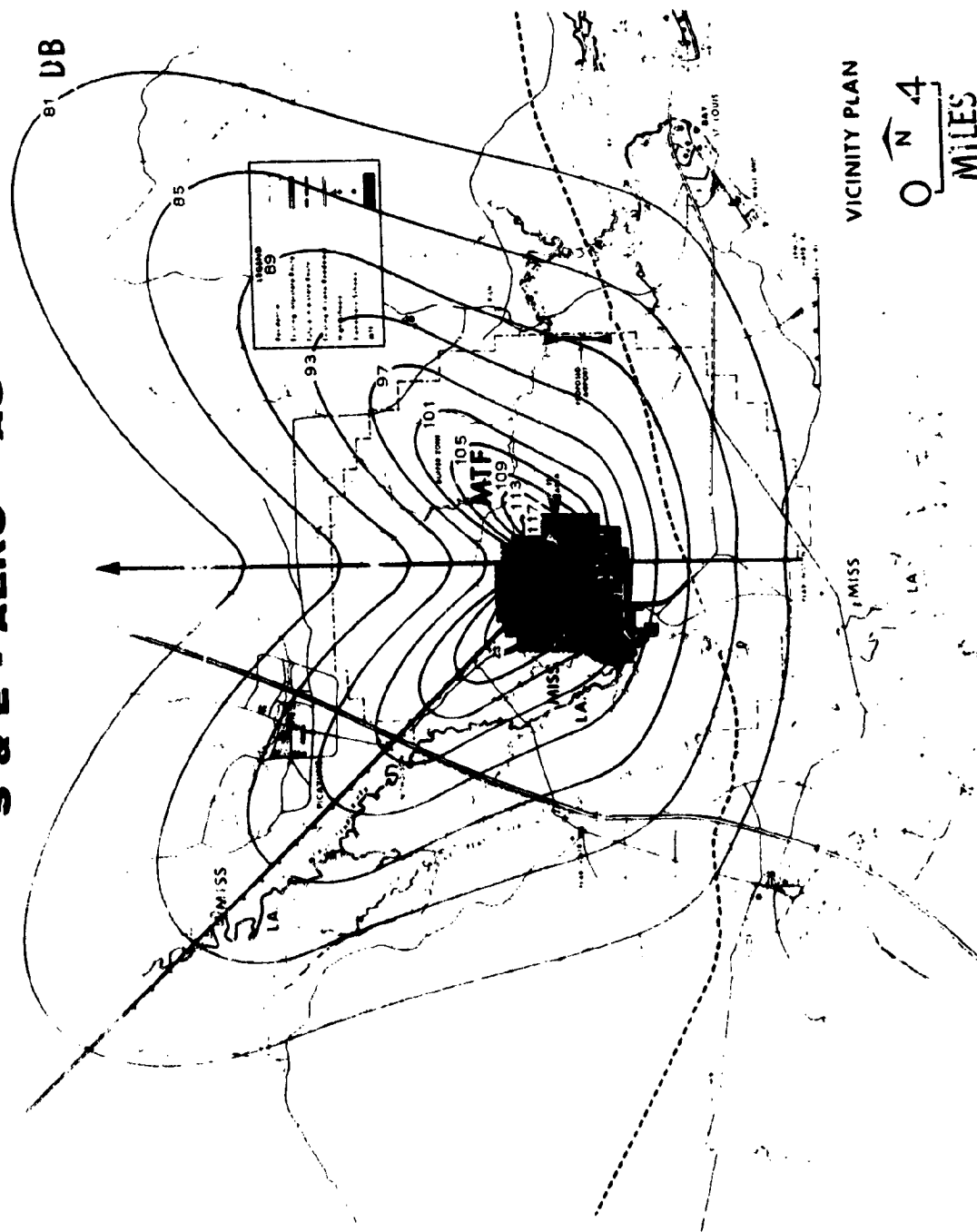
at average driving speeds is more than would be anticipated for the external rocket noise environment, with no problems anticipated.

Summary

If tests are conducted under favorable atmospheric conditions, the reaction of the community reaction should be minimal. Even at the highest level of anticipated outside the buffer zone the claim or complaint rate should be less than one in ten thousand dwellings exposed. For reduced OA SPL's at greater distances from the test site the claim rate is likewise reduced.

For car passage through the Federal Highway 10 area of the buffer zone the rocket noise levels as compared to the internal car noise environment are considered no problem for normal highway speed ranges. Warning signs possibly with lights may be considered as a means of alerting drivers in the buffer zone of the test and resulting noise environment. Any "startle" effect may be minimized in this manner.

**OVERALL SOUND PRESSURE LEVEL CONTOURS
SSME SINGLE ENGINE STATIC FIRING AT MTF
THRUST = 375,000 lb - STD. ATMOSPHERE
S & E - AERO - AU**



APPENDIX C 4

ACOUSTIC ENVIRONMENTS AT MISSISSIPPI TEST FACILITY FROM SPACE SHUTTLE ORBITER STATIC TESTS

Acoustic environmental impact on the surrounding community area at MTF for the Space Shuttle Orbiter static firing, and comments from related MTF test history are as follows:

The SSME cluster consists of: 3 High P_c engines
Thrust = 375,000 lbs (each)
Velocity = 11,680 ft/second
Diameter = 90.7 inches (each)
 $\dot{m} = 1029.5$ lb/sec (each)
with S-IC bucket deflector

Comparison of Power Spectra

The SSME cluster's acoustic power spectrum is compared with that of the S-IC booster in figure 1. The overall power spectrum, being representative of the acoustic power available at the source, indicates that the energy below 10 Hz for the SSME cluster is ≈ 10 dB less than that for the S-IC; likewise for the farfield levels in that frequency band. It may be noted that the band from 5 Hz to 50 Hz is primarily the source of structural damage related claims and complaints. The energy from 50 Hz to 100 Hz for the two are comparable; the energy for the SSME cluster exceeds that for the S-IC by ≈ 5 dB for frequencies above 100 Hz. However, this latter range is not greatly significant, since higher frequencies do not contribute as much to structural damage and are more readily absorbed in propagation to farfield community areas.

Sound Pressure Level Contours

The overall sound pressure level contours (figure 2) predicted for the SSME cluster indicates that the maximum OA SPL outside the buffer

zone is approximately 104 dB (Re: 2×10^{-5} N/m², used as standard reference herein) occurring in the maximum radiation lobe at $\approx 420^\circ$ rather than at 490° from the exhaust flow centerline as was observed from S-IC data. This environment is for standard atmospheric conditions, i.e., no focal conditions.

From MTF history with S-IC testing, it is known that the atmospheric conditions can distort the OA SPL contours both favorably and unfavorably; returning rays can increase the sound pressure levels and consequently the land area with given OA SPL contour lines increase. From S-IC data the exposed area changed by a factor of ≈ 10 in the range of 90 to 100 dB and by as much as a factor of ≈ 5 from 100 to 105 dB due to atmospheric variation. If the area within an OA SPL contour line is increased by a given factor then the probability of complaints and claims in that area, in general, increase by a like factor, and conversely for decreased levels and areas.

Acoustic Environmental Damage Claims

The data curve of Damage Claims for Households Exposed to Various OA SPL's, figure 3, was obtained from S-IC tests at MTF and is felt generally applicable and conservative for the situation with the SSME cluster tests, considering the proper acoustic energy levels for the bands responsible for structural damage. From the S-IC data it is observed that for OA SPL's of 100 to 105 dB, approximately one household in 10,000 would be expected to claim damage from the acoustic environment. For the Orbiter Test the lower frequency energy bands (5 to 20 Hz) relative to the higher frequency energy bands (above 50 Hz) are several decibels lower than that observed from S-IC spectrum. Therefore the structural household type damage claims induced by the same OA SPL should be lower for the SSME than for the S-IC tests and should conservatively approach only two to three claims per 100,000 households if tests are conducted with no focal conditions. For test on days with returning rays, claims can increase drastically (i.e., from approximately 0 to 50 as observed from S-IC test history). The community response potential for the SSME cluster should compare favorably with that of the S-II tests at MTF which induced only seven total claims (80 dB to 105 dB - none paid) over the test period of almost five years.

The noise impact in the area of Federal Interstate Highway 10, bisecting the southern half of the MTF buffer zone, is considered here briefly. The maximum OA SPL for the highway should be at approximately three miles SSE of the test area. The OA SPL at that point is 98 dB (octave band peak in the 32 Hz band). From tests conducted at MSFC on cars made by three large automotive manufacturers, approximately 98 dB OA SPL is observed in a family-type car with closed windows at approximately 30 mph or with windows open at about 20 mph, although the energy spectra are not the same. With window closed at 60 mph

the OA SPL is 104 dB; at 70 mph, 105.5 dB. Considering the standardized frequency weighting A scale network, intended (though somewhat lacking) to resemble the human's auditory perception function, the dB (A) level at three miles SSE of the stand (maximum level on the highway) is estimated at 93 dB (A). The dB (A) passenger levels in a car with open windows would be estimated at a similar level at just over 100 mph (*). With windows closed the passenger level is only 74 dB (A) at 60 mph, and only reaches 80 dB (A) at 90 mph (*extrapolated from data up to 80 mph). With car windows closed and with the car subjected to rocket engine induced environments the acoustic transmission loss (due to the car's structure) and noise reduction (internal absorption, etc.), for a particular car might then be important. This is true especially concerning the dB (A) scale, since the transmission loss (TL) and noise reduction (NR) is negligible for the lower frequencies, i. e., below ≈ 50 Hz. The TL and NR are more significant for higher frequencies, i.e., above 500 Hz. These values are not readily available at present, but they are known to differ drastically with car types, age, make, condition, etc.; thus the minimum NR and TL should possibly be assumed for conservatism, i.e., convertibles have little or no transmission loss at these frequencies.

Summary

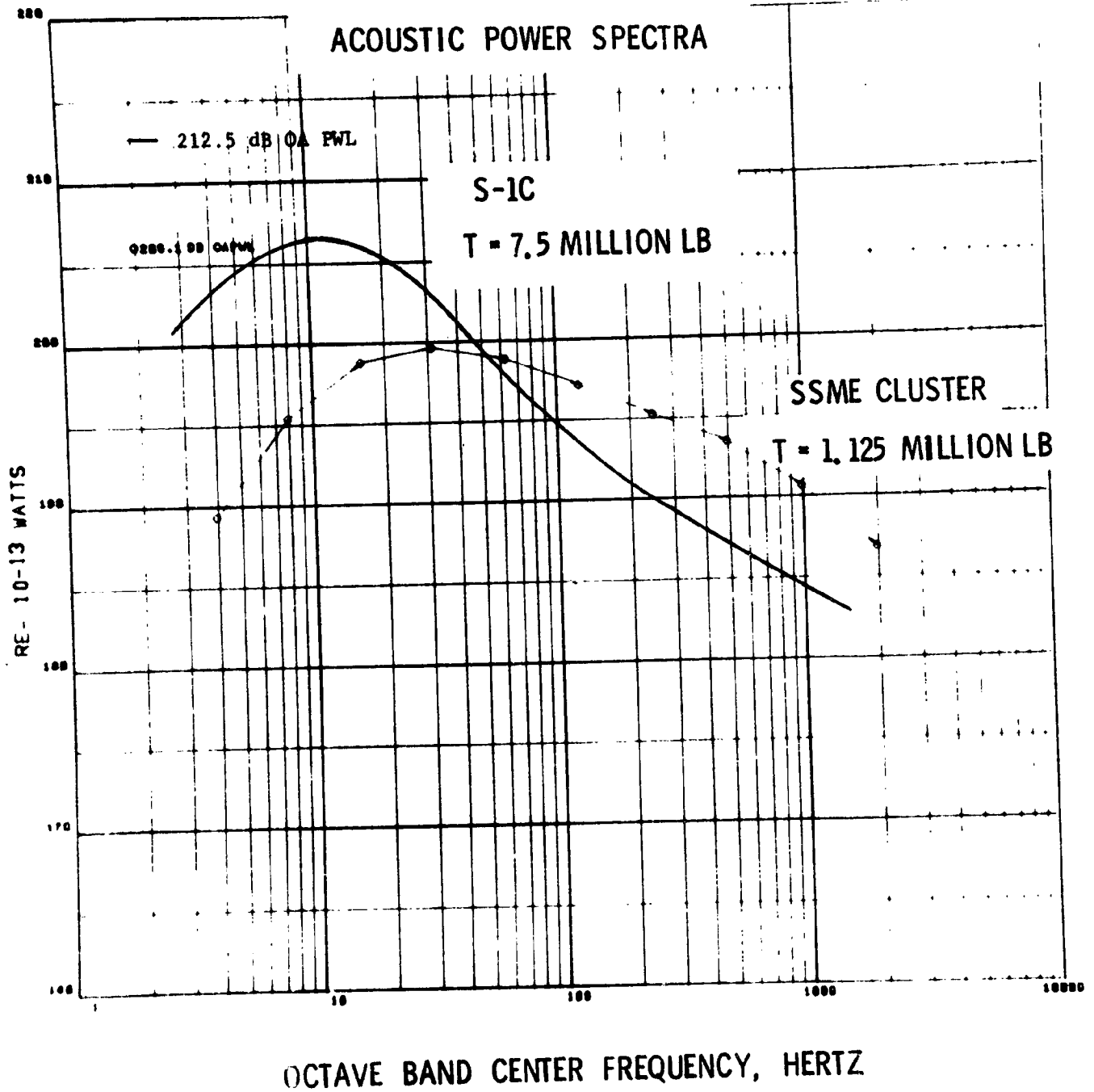
If tests are conducted under favorable atmospheric conditions (no focusing conditions) the community environmental reaction should be minimal. The test program's community impact should be similar to that observed from the S-II test program, i.e., less than two claims per year with no paid claims or apparent organized community actions. Meteorological control should be emphasized.

Also, it could be summarized that on Federal Interstate Highway 1- even though a car's internal OA SPL may be more than produced by the Orbiter tests, the energy spectrum is different for the two sources; i.e., energy spectra for tire/road noise plus car engine noise plus aerodynamic noise and buffeting, is not always greater than each energy band of the rocket engine noise spectra. The rocket engine noise thus could be differentiated from the normal car noise because of the spectral differences and could be mistaken as an "abnormal car noise," having the consequence of possibly producing the additional startle effect as "car trouble" noise. It cannot be stated that this environmental problem goes without concern even though it is one of low energy content since startle effects are subjective and are difficult to evaluate on a quantitative scale. Warning signs possibly with

4

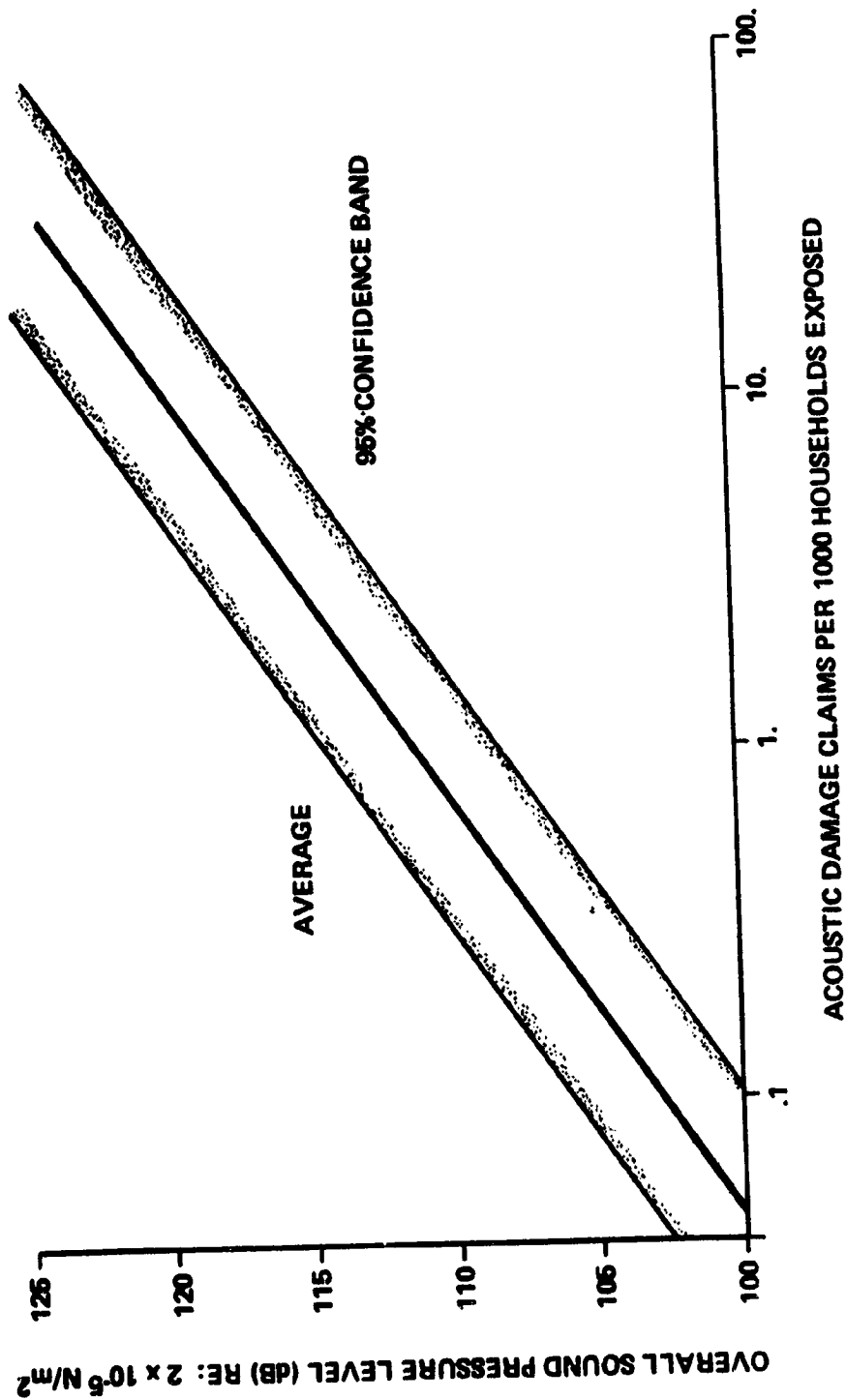
lights may be considered as a means to alert drivers to the addition noise during tests, especially if new federal criteria or guidelines, presently being prepared, show need for such concern.

SSME CLUSTER AND S-1C ACOUSTIC POWER SPECTRA

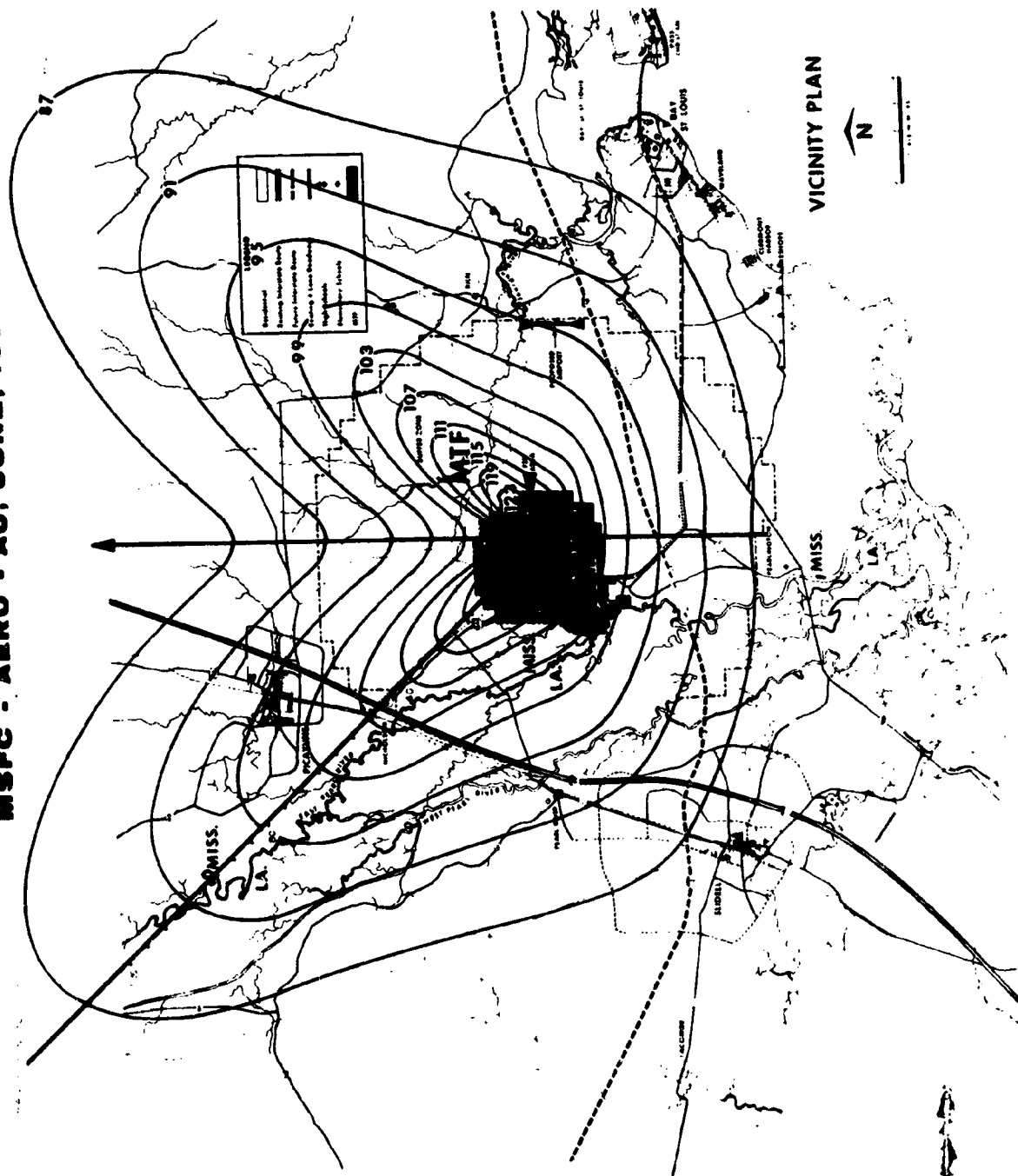


ACOUSTIC DAMAGE CLAIMS PER 1000 HOUSEHOLD
EXPOSURE vs. OVERALL SOUND PRESSURE LEVEL IN FIVE dB BANDS

S-IC STATIC TEST - MTF DATA



OVERALL SOUND PRESSURE LEVEL CONTOURS
 SSME CLUSTER STATIC FIRING AT MTF
 TOTAL THRUST = 1,125,000 LB.
 BUCKET DEFLECTOR - STD ATMOSPHERE
 MSFC - AERO - AU, JUNE, 1972



APPENDIX D

WATER MONITORING PROGRAM

TABLE 1 - REPRESENTATIVE DISCHARGE STREAM
PARAMETERS

TABLE 2 - PRESENT WATER STANDARDS COMPLIANCE
REQUIREMENTS

TABLE 3 - WATER MONITORING AND EQUIPMENT
REQUIREMENTS

TABLE 4 - SCHEMATIC FLOW DIAGRAM OF SUGGESTED
INDUSTRIAL WATER WASTE DISCHARGE AND
STORM DRAINAGE MONITORING SYSTEMS

Table 1. REPRESENTATIVE DISCHARGE STREAM PARAMETERS

Discharge Stream Designation

Discharge Stream Designation		001			002			003			004		
Parameter	Units	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
Data Required on Page 2 of ENG FORM 4348-1													
Flowrate	MGD (a)	0.27	0.23	0.24	0.23	0.18	0.18	1.29	0.88	0.84	3.9	1.75	2.4
pH	---	10.0	8.8	8.8	9.2	7.8	8.3	8.1	7.0	7.4	8.3	7.2	7.9
Temperature (Winter)	°												
Temperature (Summer)	"	83	88	83	91	84	88	93	70	88			
Data Required on Page 4 of ENG FORM 4348-1 (i.e., Part A)													
Alkalinity (as CaCO ₃)	mg/l	67		63				67		62			
B.O.D. (5-day)	"	4.7		3.7				2.3		1.3			
C.O.D. (Chem. Oxygen Demand)	"	12.4		7.8				7.0		3.2			
Total Solids	"	141		32				167		132			
Total Dissolved Solids	"	138		1.9				151		128			
Total Suspended Solids	"	7.7		4.1				6.8		3.8			
Total Volatile Solids	"	68		84				66		49			
Ammonia (as N)	"	0.12		0.07				0.18		0.08			
Kjeldahl Nitrogen	"	0.70		0.38				0.33		0.24			
Nitrate (as N)	"	0.14		0.10				0.48		0.23			
Phosphorus-Total (as P)	"	0.23		0.18				0.21		0.15			
Data Required on Pages 18 - 78 of ENG FORM 4348-1 (i.e., Part B) - Per SIC 347 Classification													
Chloride	mg/l	32		24		20		18		80		13	11
Cyanide	"	0.04		0.03		0.07		0.04		0.15			
Sulfate (as S)	"	8.4		7.3		7.3		9.8					
Sulfide (as S)	"	0		0		0		0		0			
Aluminum-Total	µg/l	880		220		370		180					
Cadmium-Total	"	7		4.8		8		6					
Chromium-Total	"	7		3.8		1.0		0.7		0			
Copper-Total	"	9		7		9		8.5					
Mercury-Total	"												
Nickel-Total	"	22		17		12		9.5					
Silver-Total	"	2.7		1.8		2.8		1.8					
Data Required on Pages 18 - 78 of ENG FORM 4348-1 (i.e., Part B) - Additional Parameters Checked Under Item 23 of Page 2 of ENG FORM 4348-1													
Color	Pt-Co	> 60		40									
Turbidity	Jackson	37		18									
Total Hardness	mg/l	88		66		70		67		88			
Nitrite (as N)	"	0.008		0.005		0.03		0.008					
Organic Nitrogen	"												
Phosphorus-Ortho (as P)	"												
Sulfite (as SO ₃)	"												
Fluoride	"	0.21		0.18		0.22		0.20					
Barium-Total	µg/l	<8000		<8000									
Beryllium-Total	"	<80		<80									
Calcium-Total	mg/l	28		23		28		23					
Iron-Total	µg/l	180		138		370		220					
Magnesium-Total	mg/l	8.0		4.8		8.0		4.4					
Manganese-Total	µg/l	<800		<800									
Potassium-Total	mg/l												
Sodium-Total	"	24		18		17		15.5					
Titanium-Total	µg/l												
Zinc-Total	"	7		6		11		10					
Oil and Grease	mg/l												
Phenols	µg/l												
Surfactants	mg/l												
Aldehydes	"												
Chlorinated Hydrocarbons (b)	"			0.01				0.01					
Pesticides	"												

(a) Million gallons/day
(b) Except pesticides

Table 2. Present Water Standards Compliance Requirements
(For Stream 001 ^a)

Pollutant or Parameter	Abbreviation	Maximum Monthly _b Average	Maximum Instantaneous _b Concentration
Ammonia	NH ₃	7.5	30
Arsenic	As	0.25	1
Barium	Ba	5	20
Cadmium	Cd	0.05	0.2
Chlorides	Cl	2,500	10,000
Chromium (total)	Cr	0.25	1
Copper	Cu	0.1	0.4
Cyanide (Total?)	CN	0.125	0.5
Fluorides	F	7.5	30
Gold	Au	0.25	1
Iron	Fe	1.5	6
Lead	Pb	0.25	1
Manganese	Mn	5	20
Mercury	Hg	0.0025	0.08
Nickel	Ni	0.75	3
Silver	Ag	0.05	0.2
Zinc	Zn	0.1	0.4
Total Solids	TS	2,500	10,000
pH (in std. units)	--	6.0-8.5	6.0-8.5

(a) Or Stream 002 during occasions when Industrial Sewer Lagoon may be out of service.

(b) Milligrams per liter (mg/l) or parts per million (ppm, weight basis).

TABLE 3. WATER MONITORING AND EQUIPMENT REQUIREMENTS

DISCHARGE ST

001		002 ⁽⁶⁾	
Monitoring Requirements	Equipment Requirements ⁽⁸⁾	Monitoring Requirements	Equipment Requirements ⁽⁸⁾
PHASE I OF P			
1) 24-hr daily composites	1- Proportional Flow Composite Sampler	1) 24-hr daily composites	1- Proportional Flow Composite Sampler
2) Daily, manual recordings of:		2) Daily, manual recordings of:	
a) Instantaneous temperature	Equipment is on hand	a) Instantaneous temperature	Equipment is on hand
b) Instantaneous flow rate	" (?)	b) Instantaneous flow rate	"
c) Instantaneous pH ⁽¹⁾	"	c) Instantaneous pH ⁽¹⁾	"
3) Immediate analysis of each daily composite for:		3) Immediate analysis of <u>each</u> daily composite for only the critical, most toxic pollutants, e.g.:	
a) Total chromium	Equipment is on hand	a) Total chromium	Equipment is on hand
b) Total cyanide	"	b) Total cyanide	"
c) Temperature	"	and possibly others plus	"
d) pH ⁽¹⁾	"	c) Temperature	"
e) EC ^(2,4)	"	d) pH ⁽¹⁾	"
f) ORP ^(3,4)	"	e) EC ^(2,4)	"
g) Total dissolved solids ⁽⁴⁾	"	f) ORP ^(3,4)	"
4) All of the EPA-required analyses of each <u>weekly</u> composite of the daily composites	Equipment is on hand	g) Total dissolved solids ⁽⁴⁾	"
		4) Analysis of each <u>weekly</u> composite in order to relate with the corresponding analyses of each <u>weekly</u> composite of 001.	Equipment is on hand
PHASE II OF			
1) Automatic continuous recordings of:	1- Dissolved Solids Monitor	1) Automatic continuous recordings of:	1- Dissolved Solids Monitor
a) EC ⁽²⁾	1- ORP Monitor	a) EC ⁽²⁾	1- ORP Monitor
b) ORP ⁽³⁾	1- pH Monitor	b) ORP ⁽³⁾	1- pH Monitor
c) pH ⁽¹⁾	1- Temperature Recorder	c) pH ⁽¹⁾	1- Temperature Recorder
d) Stream temperature	1- Recording Flowmeter	d) Stream temperature	1- Recording Flowmeter
e) Flow rate		e) Flow rate	
PHASE III OF			
	No additional monitoring requirements foreseen at present.	1) Automatic continuous recordings of:	1- Continuous Colorimetric Analyzer
		a) Total chromium	
		b) Total cyanide	
		c) Other selected toxic components	

Footnotes:

- (1) pH = measure of hydrogen-ion concentration
 (2) EC = Electrical conductivity
 (3) ORP = Oxidation-reduction potential

- (4) To provide background required for interpretation of data obtained during later continuous monitoring of these parameters.

LARGE STREAM⁽⁷⁾

003		004	
Monitoring Requirements	Equipment Requirements ⁽⁸⁾	Monitoring Requirements	Equipment Requirements ⁽⁸⁾

E I OF PROGRAM

<p>1) 24-hr daily composites</p> <p>2) Daily, manual recordings of:</p> <p>a) Instantaneous temperature</p> <p>b) Instantaneous flow rate</p> <p>c) Instantaneous pH⁽¹⁾</p> <p>d) Instantaneous air temperature</p> <p>e) 24-hr record of rainfall from MSFC Weather Station⁽⁵⁾</p> <p>3) Immediate analysis of <u>each</u> daily composite for:</p> <p>a) Total chromium</p> <p>b) Total cyanide</p> <p>c) Temperature</p> <p>d) pH⁽¹⁾</p> <p>e) EC^(2,4)</p> <p>f) ORP^(3,4)</p> <p>g) Total dissolved solids</p> <p>h) Oil and grease (?)</p>	<p>1- Proportional Flow Composite Sampler</p> <p>Equipment is on hand</p> <p>" (?)</p> <p>"</p> <p>"</p> <p>Equipment is on hand</p> <p>"</p> <p>"</p> <p>"</p> <p>"</p> <p>"</p> <p>"</p>	<p>1) 24-hr daily composite</p> <p>2) Daily, manual recordings of:</p> <p>a) Instantaneous temperature</p> <p>b) Instantaneous flow rate</p> <p>c) Instantaneous pH⁽¹⁾</p> <p>3) Immediate analysis of <u>each</u> daily composite for:</p> <p>a) Temperature</p> <p>b) pH⁽¹⁾</p> <p>c) EC^(2,4)</p> <p>d) ORP^(3,4)</p> <p>e) Total dissolved solids⁽⁴⁾</p> <p>f) Oil and grease (?)</p>	<p>1- Proportional Flow Composite Sampler</p> <p>Equipment is on hand</p> <p>" (?)</p> <p>"</p> <p>Equipment is on hand</p> <p>"</p> <p>"</p> <p>"</p> <p>"</p>
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E II OF PROGRAM

<p>1) Automatic continuous recordings of:</p> <p>a) Stream temperature</p> <p>b) Flow rate</p> <p>c) EC⁽²⁾</p> <p>d) ORP⁽³⁾</p> <p>e) pH⁽¹⁾</p>	<p>1- Temperature Recorder</p> <p>1- Recording Flowmeter</p> <p>1- Dissolved Solids Monitor</p> <p>1- ORP Monitor</p> <p>1- pH Monitor</p>	<p>1) Automatic continuous recordings of:</p> <p>a) Stream temperature</p> <p>b) Flow rate</p> <p>c) EC⁽²⁾</p> <p>d) ORP⁽³⁾</p> <p>e) pH⁽¹⁾</p>	<p>1- Temperature Recorder</p> <p>1- Recording Flowmeter</p> <p>1- Dissolved Solids Monitor</p> <p>1- ORP Monitor</p> <p>1- pH Monitor</p>
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E III OF PROGRAM

	No additional monitoring requirements foreseen at present.		No additional monitoring requirements foreseen at present.
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- (5) To determine dependence of flow rates of streams 003 and 004 upon rainfall.
- (6) See Schematic Flow Diagram for other recommended monitoring locations and parameters.

- (7) As designated in Corps of Engineers permit applications.
- (8) Purchase primarily sensors wherever possible; try to use and adapt instrumentation already on hand (e.g., in storage) such as recorders wherever possible.

FOLDOUT FRAME

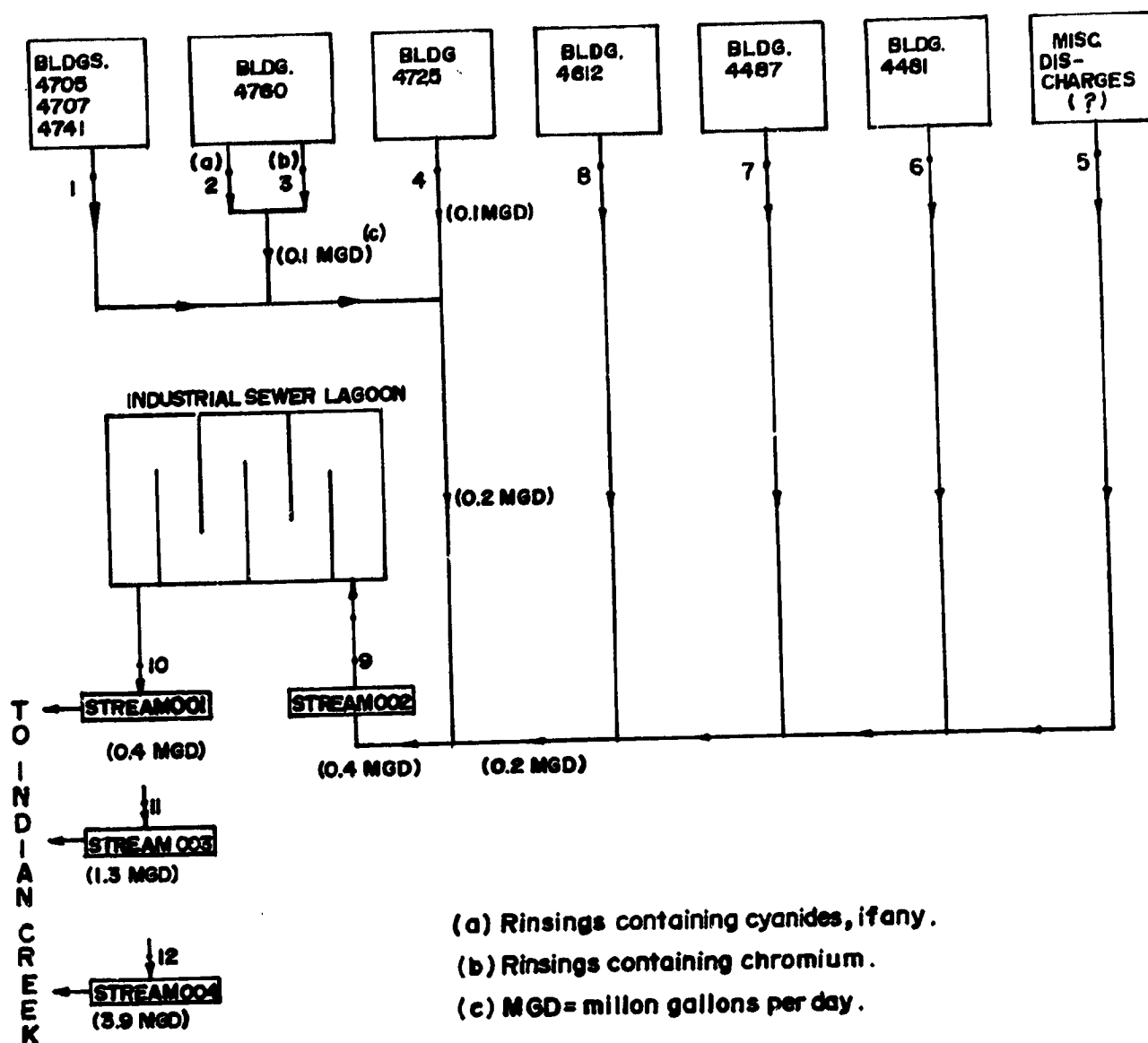


FIGURE 1: Schematic Flow Diagram of Suggested Industrial Water Waste Discharge and Storm Drainage Monitoring Systems

NOTES TO FIGURE 1

<u>Instrumentation Proposed</u>	<u>Proposed Monitoring Stations</u>											
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>
EC-R&A	X	X	X	?	?	X	X	X	X	X	X	X
F-R									?	X	?	?
ORP-R&A			X	X					X	?	?	?
pH-R&A			X	X	X				X	?	?	?
T-R&A										X	?	?

EC-R&A = Electrical Conductivity Recorder (with limit alarm)
 F-R = Flowrate Recorder
 ORP-R&A = Oxidation-Radiation Potential Recorder (with limit alarm)
 pH-R&A = pH Recorder (with limit alarm)
 T-R&A = Temperature Recorder (with limit alarm)

* * *

The EC-R&A's at Stations 1, 2, 3, and 4 can probably be combined into a single multipoint potentiometric strip chart recorder.

The ORP-R&A's at Stations 2 and 3 can probably be combined into a second recorder as above.

The pH-R&A's at Stations 2, 3, and 4 can probably be combined into a third recorder as above.

The EC-R&A's, the ORP-R&A's, and the pH-R&A's at Stations 9 and 10 can probably be handled by just three additional two-channel recorders.

The EC-R&A's at Stations 5, 6, 7, 8, 11, and 12 will probably have to be handled by separate recorders.

All alarm systems are to be transmitted to a single location (Building 4200).